Analog-Digital Converter Module

User's Manual

MITSUBISHI

Mitsubishi Programmable Logic Controller

MELSEC-Q

Q64AD
Q68ADV
Q68ADI
GX Configurator-AD (SW0D5C-QADU-E)

• SAFETY PRECAUTIONS •

(Always read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
The instructions given in this manual are concerned with this product. For the safety instructions of the PLC system, please read the user's manual for the CPU module to use.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

⚠ DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Note that the ⚠CAUTION level may lead to a serious consequence according to the circumstances. Always follow the instructions of both levels because they are important to personal safety.

Please store this manual in a safe place and make it accessible when required. Always forward it to the end user.

[DESIGN PRECAUTION]

⚠ DANGER

- Do not write data into the "system area" of the buffer memory of intelligent function modules.
  Also, do not use any "prohibited to use" signals as an output signal to an intelligent function module from the PLC CPU.
  Writing data into the "system area" or outputting a signal for "prohibited to use" may cause a PLC system malfunction.

⚠ CAUTION

- Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
  They should be installed 100mm(3.9inch) or more from each other.
  Not doing so could result in noise that may cause malfunction.

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

- Use the PLC in an environment that meets the general specifications contained in the user's manual of the CPU module to use.
  Using this PLC in an environment outside the range of the general specifications may cause electric shock, fire, malfunction, and damage to or deterioration of the product.
- When installing the module, securely insert the module fixing tabs into the mounting holes of the base unit while pressing the installation lever located at the bottom of the module downward.
  Improper installation may result in malfunction, breakdown or the module coming loose and dropping.
  Securely fix the module with screws if it is subject to vibration during use.
- Tighten the screws within the range of specified torque.
  If the screws are loose, it may cause the module to fallout, short circuits, or malfunction.
  If the screws are tightened too much, it may cause damage to the screw and/or the module, resulting in fallout, short circuits or malfunction.
- Switch all phases of the external power supply off when mounting or removing the module.
  Not doing so may cause damage to the module.
  The system that uses the QnPHCPU allows you to change a module online. Note that there are restrictions on the modules that can be changed online and each module has a predetermined changing procedure. For details, refer to the chapter of online module change in this manual.
- Do not directly touch the conductive area or electronic components of the module.
  Doing so may cause malfunction or failure in the module.

[WIRING PRECAUTIONS]

⚠ CAUTION

- Always ground the FG terminal for the PLC.
  There is a risk of electric shock or malfunction.
- When turning on the power and operating the module after wiring is completed, always attach the terminal cover that comes with the product.
  There is a risk of electric shock if the terminal cover is not attached.
- Tighten the terminal screws within the range of specified torque.
  If the terminal screws are loose, it may result in short circuits or malfunction.
  If the terminal screws are tightened too much, it may cause damage to the screw and/or the module, resulting in short circuits or malfunction.
- Be careful not to let foreign matter such as sawdust or wire chips get inside the module.
  They may cause fires, failure or malfunction.
- The top surface of the module is covered with protective film to prevent foreign objects such as cable offcuts from entering the module when wiring.
  Do not remove this film until the wiring is complete.
  Before operating the system, be sure to remove the film to provide adequate ventilation.

[STARTING AND MAINTENANCE PRECAUTIONS]

⚠ CAUTION
• Do not disassemble or modify the modules. Doing so could cause failure, malfunction injury or fire. • Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause failure or malfunction of the module. The system that uses the QnPHCPU allows you to change a module online. Note that there are restrictions on the modules that can be changed online and each module has a predetermined changing procedure. For details, refer to the chapter of online module change in this manual. • Do not touch the connector while the power is on. Doing so may cause malfunction. • Switch all phases of the external power supply off when cleaning or retightening the terminal screws and module installation screws. Not doing so may cause failure or malfunction of the module. If the screws are loose, it may cause the module to fallout, short circuits, or malfunction. If the screws are tightened too much, it may cause damages to the screws and/or the module, resulting in the module falling out, short circuits or malfunction. • Always make sure to touch the grounded metal to discharge the electricity charged in the body, etc., before touching the module. Failure to do so may cause a failure or malfunctions of the module.

[DISPOSAL PRECAUTIONS]

⚠ CAUTION
• When disposing of this product, treat it as industrial waste.

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REVISIONS

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INTRODUCTION

Thank you for purchasing the MELSEC-Q series PLC.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Q series PLC you have purchased, so as to ensure correct use.
Please forward a copy of this manual to the end user.

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Conformation to the EMC Directive and Low Voltage Instruction

For details on making Mitsubishi PLC conform to the EMC directive and low voltage instruction when installing it in your product, please see Chapter 3, "EMC Directive and Low Voltage Instruction" of the User's Manual (Hardware) of the PLC CPU to use.

The CE logo is printed on the rating plate on the main body of the PLC that conforms to the EMC directive and low voltage instruction.

By making this product conform to the EMC directive and low voltage instruction, it is not necessary to make those steps individually.

About the Generic Terms and Abbreviations

Unless otherwise specified, this manual uses the following general terms and abbreviations.

Abbreviation/general terms	Description of the abbreviation/general terms
A/D converter module	Generic term for Q64AD, Q68ADI, Q68ADV
Personal computer	IBM PC/AT® or compatible computer with DOS/V.
GX Developer	Generic product name of the product types SWnD5C-GPPW-E, SWnD5C-GPPW-EA, SWnD5C-GPPW-EV and SWnD5C-GPPW-EVA. "n" in the model name is 4 or greater.
GX Configurator-AD	Generic term for analog-digital converter module setting and monitor tool GX Configurator-AD (SW0D5C-QADU-E)
QCPU (Q mode)	Generic term for Q00JCPU, Q00CPU, Q01CPU, Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU
QnPHCPU	Generic term for Q12PHCPU and Q25PHCPU.
Personal computer	Generic term for DOS/V personal computer
Factory setting	Generic term for analog input ranges 0 to 10V, 0 to 5V, 1 to 5V, -10 to 10V, 0 to 20mA and 4 to 20mA

Product Structure

The product structure of this product is given in the table below.

Model code	Product name	Quantity
Q64AD	Q64AD Model Analog-Digital Converter Module	1
Q68ADV	Q68ADV Model Analog -Digital Converter Module	1
Q68ADI	Q68ADI Model Analog -Digital Converter Module	1
SW0D5C-QADU-E	GX Configurator-AD Version 1 (1-license product) (CD-ROM)	1
SW0D5C-QADU-EA	GX Configurator-AD Version 1 (Multiple-license product) (CD-ROM)	1

1 OVERVIEW

This User's Manual describes the specifications, handling and programming methods for the Q64AD analog-digital converter module (hereinafter referred to as the Q64AD), Q68ADV analog-digital converter module (hereinafter referred to as the Q68ADV), and Q68ADI analog-digital converter module (hereinafter referred to as the Q68ADI), which are used in conjunction with MELSEC-Q Series CPUs.
In this manual, the Q64AD, Q68ADV, and Q68ADI are collectively referred to as the A/D converter modules.

1.1 Features

(1) Select the type of module according to the application.

- Q64AD ····· 4 channels, where the voltage input or current input can be selected for each channel.
- Q68ADV ····· 8 channels, all of which are voltage input.
- Q68ADI ····· 8 channels, all of which are current input.

(2) High speed conversion

Conversion is performed at a high speed of 80 μ s/channel. Also, the temperature drift compensation function can be performed using a processing time of "conversion time for all channels + 160 μ s".

(3) High degree of accuracy

The degree of accuracy for the conversion process is ± 0.1% (When the ambient temperature is 25 ± 5 °C).

(4) Changing the resolution mode

The resolution mode can be changed according to the application, and digital-value resolution settings of 1/4000, 1/12000 or 1/16000 can be selected.

(5) Changing the input range

The input range ＊1 can easily be set from the GX Developer.
＊1: Input range refers to the type of offset/gain settings. The most frequently used range is set as the default but the user can also set the offset/gain.

(6) Easy settings using the utility package

A utility package is sold separately (GX Configurator-AD).
The utility package is not a required item. However, it can be used to set initial settings and automatic refresh settings on screen, reduce sequence programs, and check settings and operating status.

1.2 Functions Added to Function Version B and Later

(1) Functions added to function version B

The functions added by the function version B A/D converter module are listed below.

Item	Function overview	Reference section
Multiple PLC system compatibility	Compatible with a multiple PLC system. A PLC CPU of function version B or later are required.	Section 2.1
Resolution mode	The resolution mode can be changed according to the application, and digital-value resolution settings of 1/4000, 1/12000 or 1/16000 can be selected.	Section 3.2
High resolution mode status flag (X8)	This turns ON when in high resolution mode.	Section 3.3
Maximum value/minimum value reset completed flag (XD)	This turns ON when the maximum and minimum values stored in buffer memory addresses 30 to 45 are reset by the maximum value/minimum value reset request (YD).	Section 3.3

(2) Functions added to function version C

The functions added to the A/D converter module of function version C are listed below.

Item	Function overview	Reference section
Online module change	You can change the module without stopping the system. A PLC CPU of function version C or later is required.	Chapter 7
Mode switching that does not require PLC CPU to be reset	Using the mode switching setting (buffer memory addresses 158, 159: Un\G158, Un\G159) and operation condition setting request (Y9), the module is switched between the normal mode and offset/gain setting mode without the PLC CPU being reset.	Section 3.4.13
	Using the dedicated instruction (G.OFFGAN), the module is switched between the normal mode and offset/gain setting mode without the PLC CPU being reset.	Appendix 2.1
	Using GX Configurator-AD, the module is switched between the normal mode and offset/gain setting mode without the PLC CPU being reset.	Section 5.6.2

POINT

(1) See Appendix 1.1 for a comparison of functions of the function version.
(2) See Section 2.2 on how to check the function version.

2 SYSTEM CONFIGURATION

2.1 Applicable Systems

This section describes the system configuration for the A/D converter module.

(1) Applicable module and the number of modules that can be installed

The following are the CPU module and network module (for remote I/O stations) in which the A/D converter module can be installed and the number of modules that can be installed.

Applicable module		Number of modules that can be installed	Remarks
CPU module	Q00JCPU	Maximum 16	(*1)
	Q00CPU Q01CPU	Maximum 24	
	Q02CPU Q02HCPU Q06HCPU Q12HCPU Q25HCPU	Maximum 64	Can be installed in Q mode only (*1)
	Q12PHCPU Q25PHCPU	Maximum 64	(*1)
Network module	QJ72LP25-25 QJ72BR15 QJ72LP25G QJ71LP25GE	Maximum 64	MELSECNET/H Remote I/O station (*2)

*1 See User's Manual (Function Explanation, Program Fundamentals) for the CPU module to use.
*2 See Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network).

(2) Base Unit in which the converter module can be installed

The A/D converter module can be installed in any I/O slot (*3) of the base unit. However, a power shortage may occur depending on the combination with other installed modules and the number of modules used, so always take into consideration the power supply capacity when installing modules.

*3 Limited to the range of the number of I/O points in the CPU module and network module (for remote I/O stations).

(3) Compatibility with a multiple PLC system

First read the QCPU (Q mode) user's manual (Function Explanation, Program Fundamentals) if the A/D converter module is used with a multiple PLC system.

(a) Compatible A/D converter module
Use an A/D converter module with function version B or higher if using the module in a multiple PLC system.

(b) Intelligent function module parameters
Perform PLC write of the intelligent function module parameters to the control PLC of the A/D converter module only.

(4) Compatibility with online module change

To make an online module change, use the module of function version C or later.

POINT
The products of function version C include the functions of the products of function versions A and B.

(5) Software packages supported

Correspondence between systems which use A/D converter modules and software packages are as shown below.

The GX Developer is necessary when using a A/D converter module.

		Software Version	
		GX Developer	GX Configurator-AD ＊4
Q00J/Q00/Q01CPU	Single PLC system	Version 7 or later	Version 1.10L or later (cannot be used with the SW0D5C-QADU-E 50F or earlier versions).
	Multiple PLC system	Version 8 or later	
Q02/Q02H/Q06H/ Q12H/Q25HCPU	Single PLC system	Version 4 or later	SW0D5C-QADU-E 00A or later
	Multiple PLC system	Version 6 or later	SW0D5C-QADU-E 20C or later
Q12PH/Q25PHCPU	Single PLC system	Version 7.10L or later	Version 1.13P or later (cannot be used with the SW0D5C-QADU-E 50F or earlier versions).
	Multiple PLC system		
If installed in a MELSECNET/H remote I/O station		Version 6 or later	SW0D5C-QADU-E 50F or later

＊4 Refer to Appendix 1.2 for the combinations of the A/D converter module functions and GX Configurator-AD software versions.

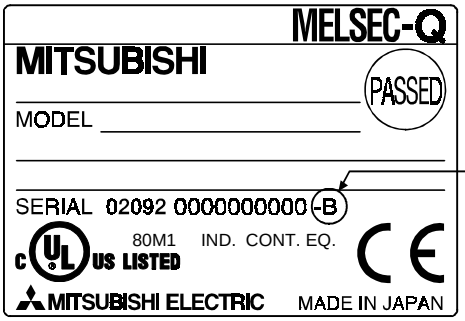
2 - 2

2.2 How to Check the Function Version and Software Version

This section describes how to check the function version of the A/D converter module and the GX Configurator-AD software version.

(1) How to check the function version of the A/D converter module

(a) To check the version using the "SERIAL column of the rating plate" located on the side of the module



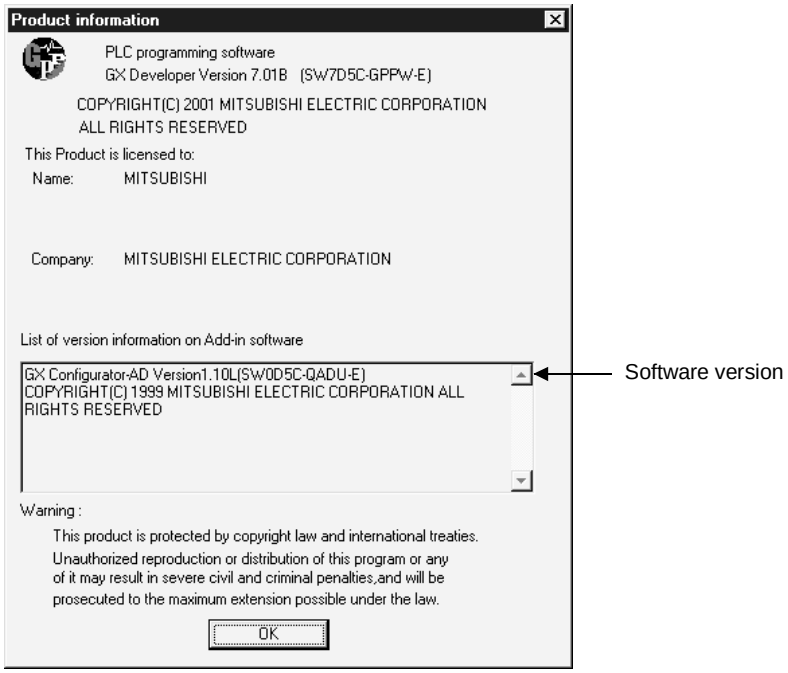
(b) To check the version using the GX Developer
See Section 8.2.4 of this manual.

(2) How to check the GX Configurator-AD software version

The GX Configurator-AD software version can be checked in GX Developer's "Product information" screen.

[Startup procedure]

GX Developer → "Help" → Product information



(In the case of GX Developer Version 7)

REMARK

The version indication for the GX Configurator-AD has been changed as shown below from the SW0D5C-QADU-E 50F upgrade product.

Previous product		Upgrade and subsequent versions
SW0D5C-QADU-E 50F	→	GX Configurator-AD Version 1.10L

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3 SPECIFICATIONS

3.1 Performance Specifications

3.1.1 Performance specifications list

Table 3.1 shows the performance specifications of the A/D converter modules.

Table 3.1 Performance specifications

Item \ Model name		Q64AD	Q68ADV	Q68ADI
Analog input points		4 points (4 channels)	8 points (8 channels)	8 points (8 channels)
Analog input	Voltage	–10 to 10 V DC (Input resistance value 1M Ω)		———
	Current	0 to 20 mA DC (input resistance value 250 Ω)	———	0 to 20 mA DC (input resistance value 250 Ω)
Digital output		16-bit signed binary (normal resolution mode: –4096 to 4095, high resolution mode: –12288 to 12287, –16384 to 16383		

I/O characteristics, Maximum resolution

Analog input range		Normal resolution mode: Digital output value	Normal resolution mode: Maximum resolution	High resolution mode: Digital output value	High resolution mode: Maximum resolution
Voltage	0 to 10 V	0 to 4000	2.5 mV	0 to 16000	0.625 mV
	0 to 5 V		1.25 mV	0 to 12000	0.416 mV
	1 to 5 V		1.0 mV		0.333 mV
	–10 to 10 V	–4000 to 4000	2.5 mV	–16000 to 16000	0.625 mV
	Users range setting		0.375 m V	–12000 to 12000	0.333 mV
Current	0 to 20 mA	0 to 4000	5 μA	0 to 12000	1.66 μA
	4 to 20 mA		4 μA		1.33 μA
	Users range setting	–4000 to 4000	1.37 μA	–12000 to 12000	1.33 μA

Accuracy (Accuracy in respect to maximum digital output value)

Analog input range		Normal resolution mode: Ambient temperature 0 to 55 °C: With temperature drift correction	Normal resolution mode: Ambient temperature 0 to 55 °C: Without temperature drift correction	Normal resolution mode: Ambient temperature 25 ± 5 °C	High resolution mode: Ambient temperature 0 to 55 °C: With temperature drift correction	High resolution mode: Ambient temperature 0 to 55 °C: Without temperature drift correction	High resolution mode: Ambient temperature 25 ± 5 °C
Voltage	0 to 10 V	± 0.3 % (± 12 digit ＊)	± 0.4 % (± 16 digit ＊)	± 0.1 % (± 48 digit ＊)	± 0.3 % (± 48 digit ＊)	± 0.4 % (± 64 digit ＊)	± 0.1 % (± 16 digit ＊)
	–10 to 10 V						
	0 to 5 V						
	1 to 5 V						
	Users range setting				± 0.3 % (± 36 digit ＊)	± 0.4 % (± 48 digit ＊)	± 0.1 % (± 12 digit ＊)
Current	0 to 20 mA						
	4 to 20 mA						
	Users range setting						

＊ Digit indicates a digital value.

3 - 1

Item \ Model name	Q64AD	Q68ADV	Q68ADI
Conversion speed	80 μ s/channel (When there is temperature drift, the time calculated by adding 160 μ s will be used regardless of the number of channels used)		
Absolute maximum input	Voltage : ± 15 V Current : ± 30 mA		
E^2PROM write count	Max. 100 thousand times		
Insulation method	Between the I/O terminal and PLC power supply : Photocoupler insulation Between channels : Non-insulated		
Dielectric withstand voltage	Between the I/O terminal and PLC power supply: 500VAC for 1 minute		
Insulation resistance	Between the I/O terminal and PLC power supply: 500VDC 20MΩ or more		
Number of occupied points	16 points		
Connection terminals	18-point terminal block		
Applicable wire size	0.3 to 0.75 mm^2		
Applicable solderless terminal	R1.25-3 (A solderless terminal with sleeve cannot be used)		
Internal current consumption (5 V DC)	0.63 A	0.64 A	0.64 A
Weight	0.18 kg	0.19 kg	0.19 kg

REMARK

See the user's manual for the CPU module being used for general specifications of the A/D converter modules.

3.1.2 I/O conversion characteristic

The I/O conversion characteristic represents the angle formed by a straight line connecting the "offset value" and "gain value" when the analog signals (voltage or current input) from outside the PLC are converted to digital values.

Offset value

The offset value denotes the analog input value (voltage or current) that makes the digital output value 0.

Gain value

The gain value denotes the analog input value (voltage or current) that makes the digital output value:

4000 (in normal resolution mode)

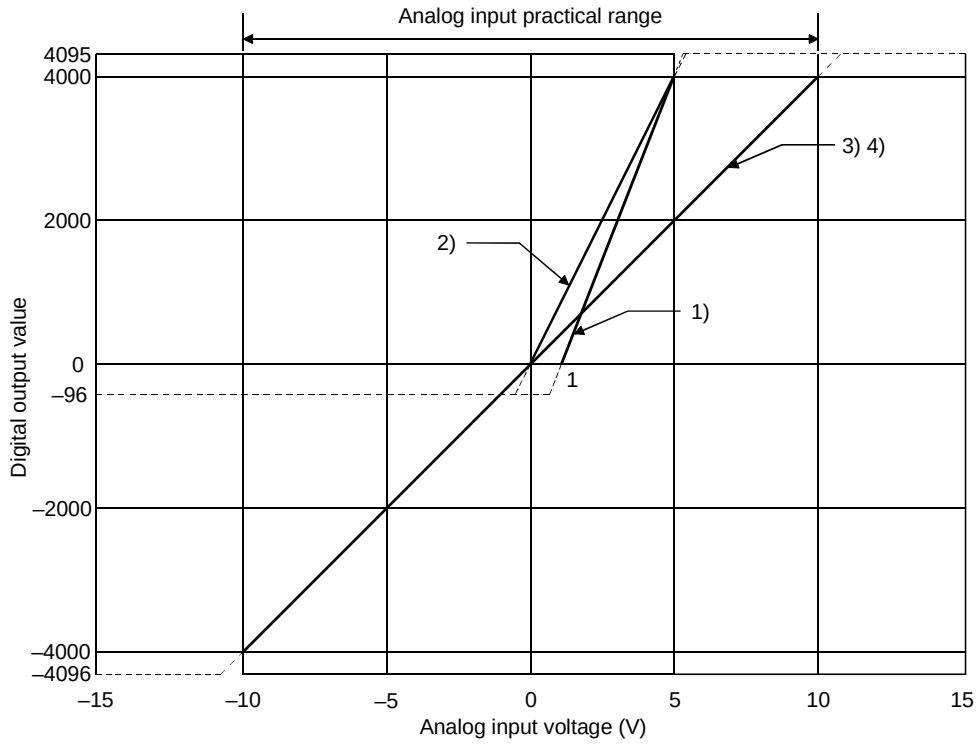
12000 (when 0 to 5 V, 1 to 5 V, 4 to 20 mA, 0 to 20 mA or the user range setting is selected in high resolution mode)

16000 (when -10 to 10 V or 0 to 10 V is selected in high resolution mode).

(1) Voltage input characteristic

(a) Voltage input characteristic in normal resolution mode

Figure 3.1 shows a graph of the voltage input characteristic in normal resolution mode.

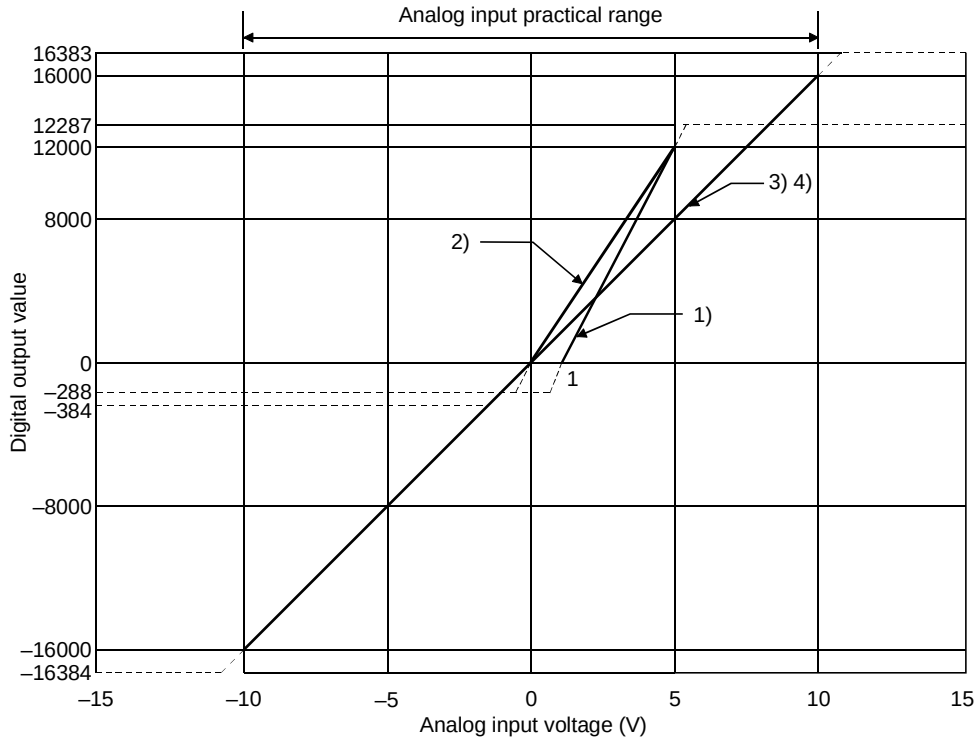


Number	Analog input range setting	Offset value	Gain value	Digital output value ∗2	Maximum resolution
1)	1 to 5 V	1 V	5 V	0 to 4000	1.0 mV
2)	0 to 5 V	0 V	5 V		1.25 mV
3)	–10 to 10 V	0 V	10 V	–4000 to 4000	2.5 mV
4)	0 to 10 V	0 V	10 V	0 to 4000	2.5 mV
—	User range setting	∗1	∗1	–4000 to 4000	0.375 mV

Figure 3.1 Voltage input characteristic in normal resolution mode

(b) Voltage input characteristic in high resolution mode

Figure 3.2 shows a graph of the voltage input characteristic in high resolution mode.



Number	Analog input range setting	Offset value	Gain value	Digital output value ∗2	Maximum resolution
1)	1 to 5 V	1 V	5 V	0 to 12000	0.333 mV
2)	0 to 5 V	0 V	5 V		0.416 mV
3)	–10 to 10 V	0 V	10 V	–16000 to 16000	0.625 mV
4)	0 to 10 V	0 V	10 V	0 to 16000	0.625 mV
—	User range setting	∗1	∗1	–12000 to 12000	0.333 mV

Figure 3.2 Voltage input characteristic in high resolution mode

POINT

(1) Set within the analog input range and digital output range for each input range. If these ranges are exceeded, the maximum resolution and accuracy may not fall within the performance specifications. (Avoid using the dotted line area shown in Figures 3.1 and 3.2.)

(2) Do not input an analog input voltage of more than ± 15 V. The input elements may be damaged.

(3) Set the offset/gain values for the user setting range ✻1 within a range in which the following conditions are satisfied.
{ (Gain value) – (Offset value) } > A

<Value of A>

Normal resolution mode	High resolution mode
1.5 V	4.0 V

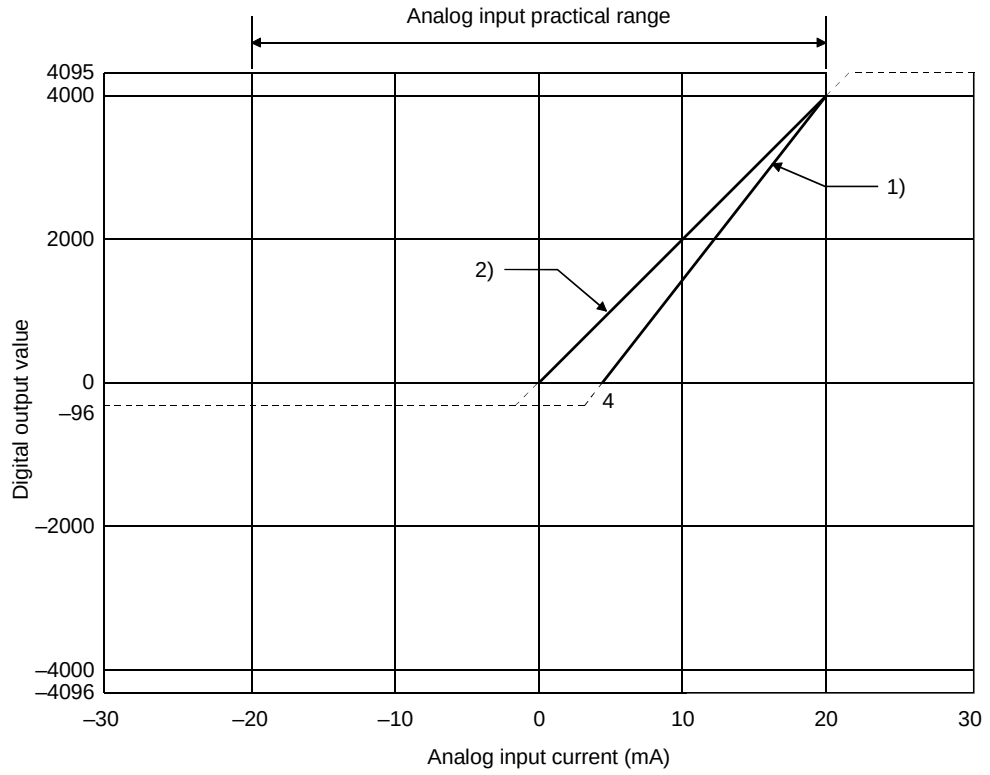
(4) When an analog value that exceeds the range for the digital output value ✻2 is entered, the digital output value will be fixed at the maximum or minimum value.

Analog input range setting	Normal resolution mode		High resolution mode	
	Minimum	Maximum	Minimum	Maximum
1 to 5 V	–96	4095	–288	12287
0 to 5 V				
–10 to 10 V	–4096		–16384	16383
0 to 10 V	–96		–384	
User range setting	–4096		–12288	12287

(2) Current input characteristic

(a) Current input characteristic in normal resolution mode

Figure 3.3 shows a graph of the current input characteristic in normal resolution mode.

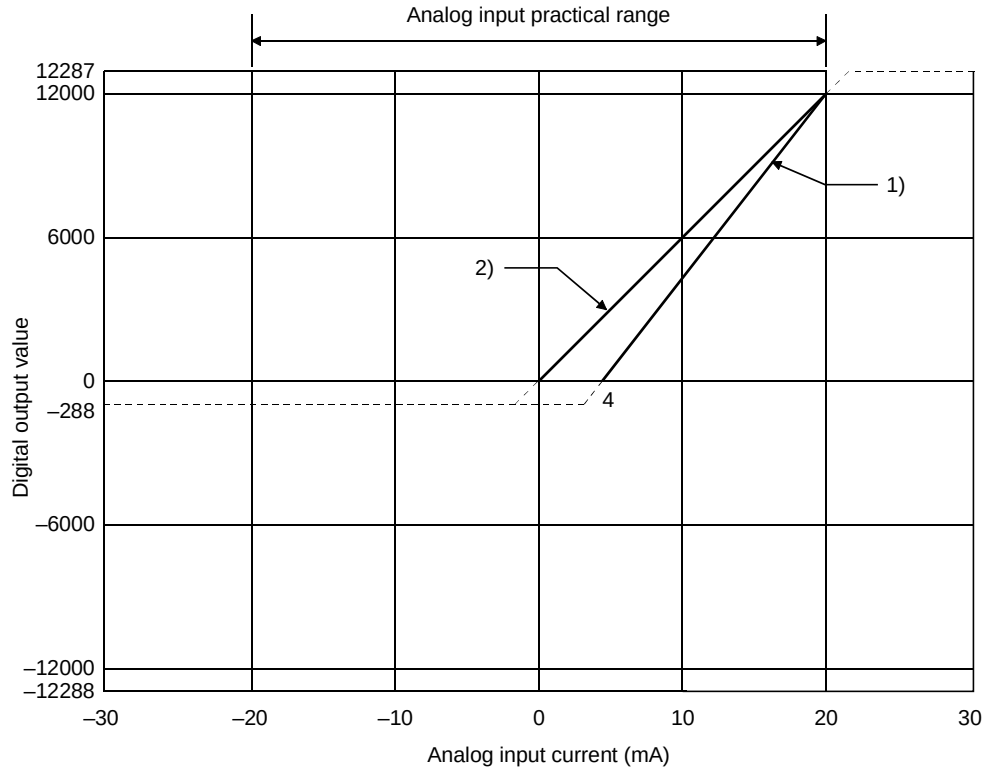


Number	Analog input range setting	Offset value	Gain value	Digital output value ∗2	Maximum resolution
1)	4 to 20 mA	4 mA	20 mA	0 to 4000	4 μA
2)	0 to 20 mA	0 mA	20 mA		5 μA
—	User range setting	∗1	∗1	–4000 to 4000	1.37 μA

Figure 3.3 Current input characteristic in normal resolution mode

(b) Current input characteristic in high resolution mode

Figure 3.4 shows a graph of the current input characteristic in high resolution mode.



Number	Analog input range setting	Offset value	Gain value	Digital output value ∗2	Maximum resolution
1)	4 to 20 mA	4 mA	20 mA	0 to 12000	1.66 μA
2)	0 to 20 mA	0 mA	20 mA		1.33 μA
—	User range setting	∗1	∗1	–12000 to 12000	1.33 μA

Figure 3.4 Current input characteristic in high resolution mode

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POINT

(1) Set within the analog input range and digital output range for each input range. If these ranges are exceeded, the maximum resolution and accuracy may not fall within the performance specifications. (Avoid using the dotted line area shown in Figures 3.3 and 3.4.)

(2) Do not input an analog input current of more than ± 30 mA. A breakdown may result due to overheating.

(3) Set the offset/gain values for the user setting range ✻1 within a range in which the following conditions are satisfied.
{ (Gain value) – (Offset value) } > A

<Value of A>

Normal resolution mode	High resolution mode
5.5 mA	16.0 mA

(4) When an analog value that exceeds the range of the digital output value ✻2 is entered, the digital output value will be fixed at the maximum or minimum value.

Analog input range setting	Normal resolution mode		High resolution mode	
	Minimum	Maximum	Minimum	Maximum
4 to 20 mA	–96	4095	–288	12287
0 to 20 mA				
User range setting	–4096		–12288	12287

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3.1.3 Accuracy

Accuracy is represented with respect to the maximum digital output value.
Accuracy does not change and remains within the range listed in the performance specification even if the input characteristic is changed by changing offset/gain settings, input range and resolution mode.
Figure 3.5 shows the range of fluctuation in accuracy when a -10 to 10V range is selected and in normal resolution mode. Accuracy is ± 0.1% (± 4 digits) when the ambient temperature is 25 ± 5°C, ± 0.3% (± 12 digits) when the ambient temperature is 0 to 55 °C with temperature drift compensation, and ± 0.4% (± 16 digits) when the ambient temperature is 0 to 55 °C without temperature drift compensation.

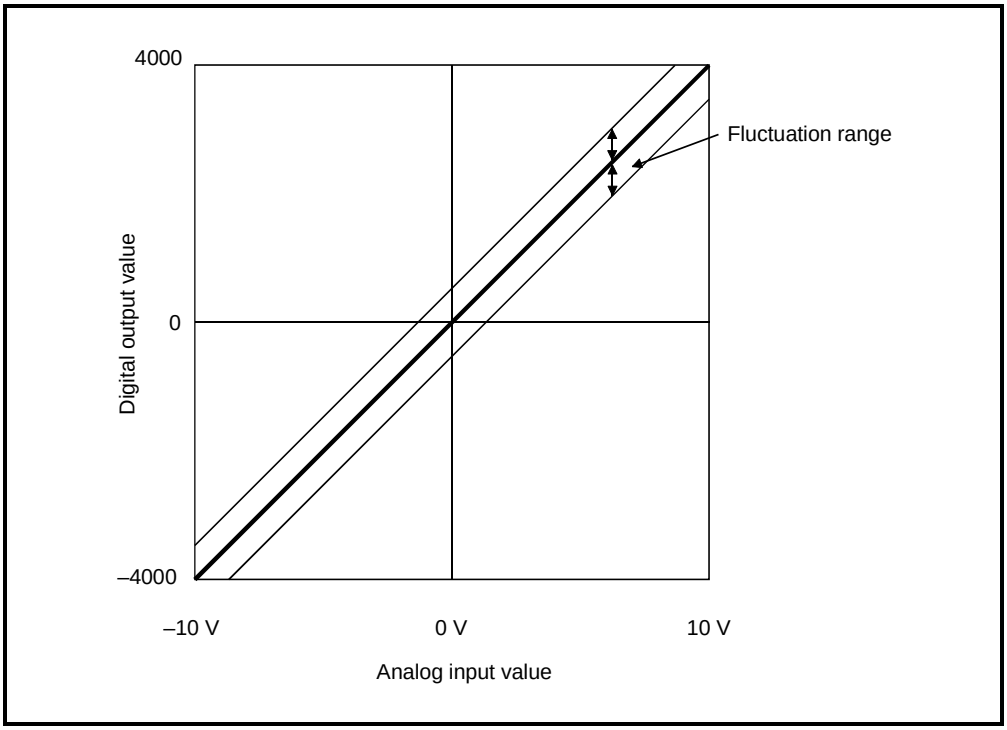


Figure 3.5 Accuracy

3.2 Function List

Table 3.2 shows the function list of the A/D converter modules.

Table 3.2 Function list

Item	Function	Reference section
A/D conversion enable/ disable setting	(1) Specifies whether to enable or disable the A/D conversion for each channel. (2) By disabling the conversion for the channels that are not used, the sampling time can be shortened.	Section 3.4.2
A/D conversion method	(1) Sampling processing The A/D conversion for analog input values is performed successively for each channel, and the digital output value is output upon each conversion. (2) Averaging processing For each channel, A/D conversion values are averaged for the set number of times or set amount of time, and the average value is output as a digital value.	Section 3.2.1
Maximum and minimum values hold function	(1) The maximum and minimum values of the digital output values is retained in the module.	Section 3.2.2
Temperature drift compensation function	(1) Errors arising from changes in the ambient temperature of the module are automatically compensated for to improve conversion accuracy. (2) The temperature drift compensation function can be performed at (A/D conversion time for all channels) + 160 μs.	———
Resolution mode	(1) The resolution mode can be switched according to the application, and digital-value resolution settings of 1/4000, 1/12000 or 1/16000 can be selected. (2) The resolution mode setting is applicable to all channels. (3) See Section 3.1.1 for the digital output values and maximum resolution in normal resolution mode and high resolution mode.	Section 3.1.1 Section 4.5
Online module change	(1) A module change is made without the system being stopped.	Chapter 7

3.2.1 A/D conversion methods

There are two A/D conversion methods, sampling processing and averaging processing.

(1) Sampling processing

A/D conversion is performed successively for the analog input value, and the converted digital output values are stored in the buffer memory.
The sampling processing time depends on the number of channels used (the number of channels set to A/D conversion enable) and whether the temperature drift compensation function is available.

(a) Without the temperature drift compensation function
(Processing time) = (Number of channels used) $\times$ 80 (μ s/1 channel)

(b) With the temperature drift compensation function
(Processing time) = (Number of channels used) $\times$ 80 (μ s/1 channel) + 160 μ s

[Example]
When three channels (channels 1, 2 and 4) are A/D conversion enabled with the temperature drift compensation function, the sampling processing time is 400 μ s.
3 $\times$ 80 + 160 = 400 (μ s)

(2) Averaging processing

For channels for which averaging processing is specified, A/D conversion is performed for the set number of times or the set amount of time. The average value is calculated from the sum of values excluding the maximum and minimum values, and then stored in the buffer memory.

(a) When averaging processing is specified for the set amount of time

1) The number of processing repetitions within the set time differs according to the number of channels used (number of channels for which A/D conversion is enabled) and whether or not temperature-drift compensation is used.

- Without the temperature drift compensation function

$$\text{(Number of processing repetitions)} = \frac{\text{(Set time)} \times 1000}{\text{(Number of channels used)} \times 80\ (\mu\text{s/1 channel})}$$

- With the temperature drift compensation function

$$\text{(Number of processing repetitions)} = \frac{\text{(Set time)} \times 1000}{\text{(Number of channels used)} \times 80\ (\mu\text{s/1 channel}) + 160}$$

[Example]
When averaging processing is performed with four channels (channels 1, 2, 3, and 4) for the set time of 50 ms with the temperature drift compensation function on, measurement is performed 104 times and the average value is output.

$$\frac{50 \times 1000}{(4 \times 80) + 160} = 104.17 \text{ (times)} \cdots\cdots \text{Round down the number.}$$

2) When 7 or 8 channels are used with the temperature drift compensation function on, set the average time to 3 ms or more.
If the time is set to 2 ms or less, the average number of times becomes less than 3 and it causes the digital output value to become 0 since a sum excluding the maximum and minimum values will be averaged.

(b) When the averaging processing is specified for the set number of times
The time required to store the average value calculated using the average number of times in the buffer memory differs according to the number of channels used (the number of channels set to A/D conversion enable) and whether or not the temperature drift compensation is used.

1) Without the temperature drift compensation function
(Processing time) = (Set number of times) $\times$
{(Number of channels used) $\times$ 80}/1000
(Unit: ms)

2) With the temperature drift compensation function
(Processing time) = (Set number of times) $\times$
[{(Number of channels used) $\times$ 80} + 160]/1000
(Unit: ms)

[Example]
When averaging processing is performed with four channels (1, 2, 3 and 4) for the set number of 100 times with temperature-drift compensation on, an average value is output every 48 ms.
100 $\times$ {(4 $\times$ 80) + 160} $\div$ 1000 = 48 (ms)

3.2.2 Maximum and minimum values hold function

(1) The maximum and minimum digital output values for each channel are stored in buffer memory addresses 30 to 45 (Un\G30 to Un\G45).

(2) When the operating condition setting completed flag (X09) turns OFF, the values are cleared to 0 and new maximum and minimum values are stored when conversion begins.

(3) Since the area for storing the maximum and minimum values can be rewritten with the sequence program, the maximum and minimum values within a specific period of time can be checked.

3.3 I/O Signals for the PLC CPU

3.3.1 List of I/O signals

Table 3.3 shows a list of the I/O signals for the A/D converter modules.
Note that I/O numbers (X/Y) shown in this chapter and thereafter are the values when the start I/O number for the A/D converter module is set to 0.

Table 3.3 List of I/O signal

Signal direction CPU ← A/D converter module		Signal direction CPU → A/D converter module	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
X0	Module READY	Y0	Use prohibited ＊1
X1	Temperature drift compensation flag	Y1	
X2	Use prohibited ＊1	Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9	High resolution mode status flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range write request
XB	Channel change completed flag	YB	Channel change request
XC	Use prohibited ＊1	YC	Use prohibited ＊1
XD	Maximum value/minimum value reset completed flag	YD	Maximum value/minimum value reset request
XE	A/D conversion completed flag	YE	Use prohibited ＊1
XF	Error flag	YF	Error clear request

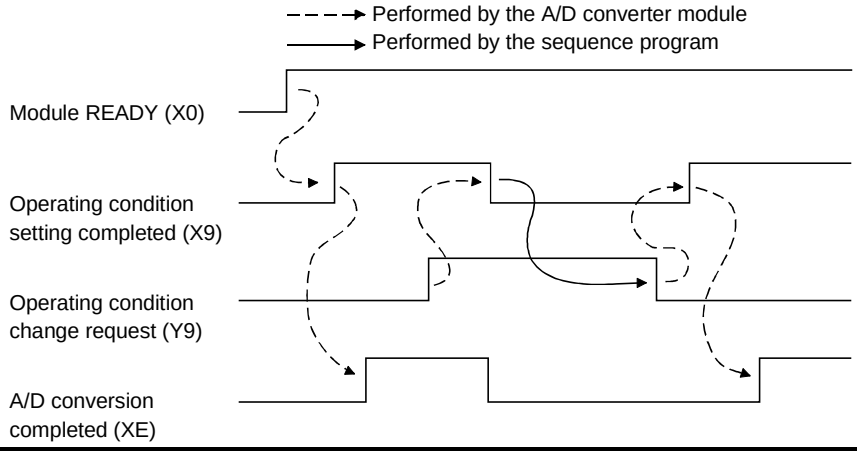
POINT

＊1 These signals cannot be used by the user since they are for system use only. If these are turned ON/OFF by the sequence program, the functioning of the A/D converter module cannot be guaranteed.

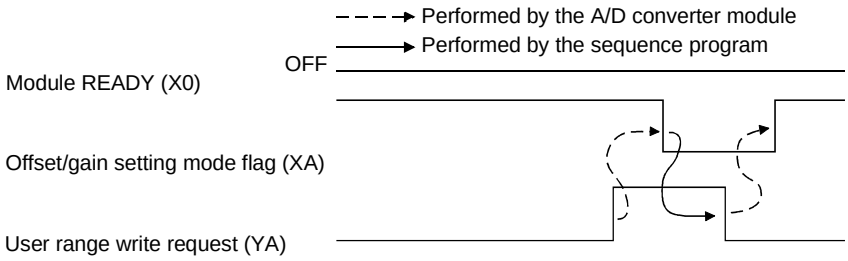
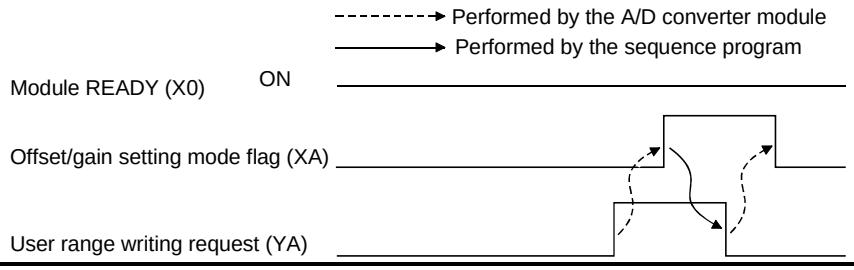
3.3.2 Details of I/O signals

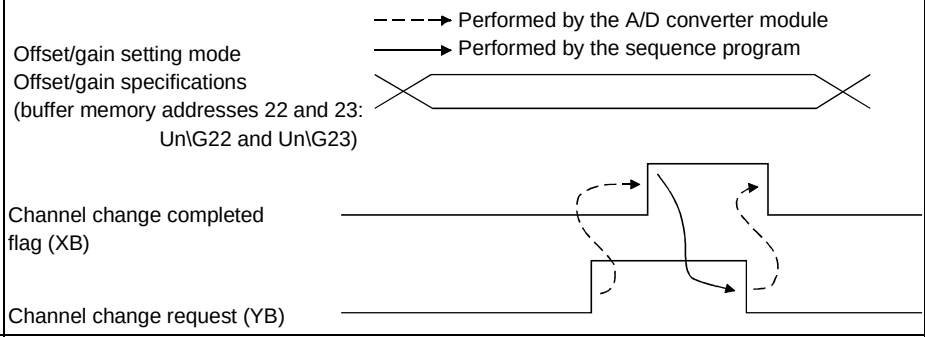
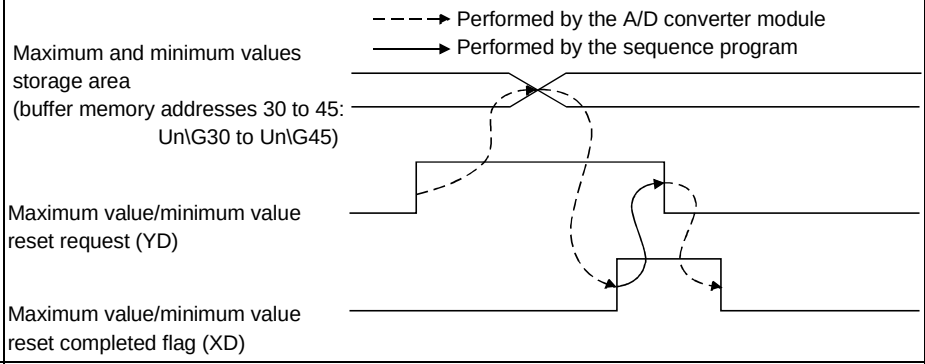
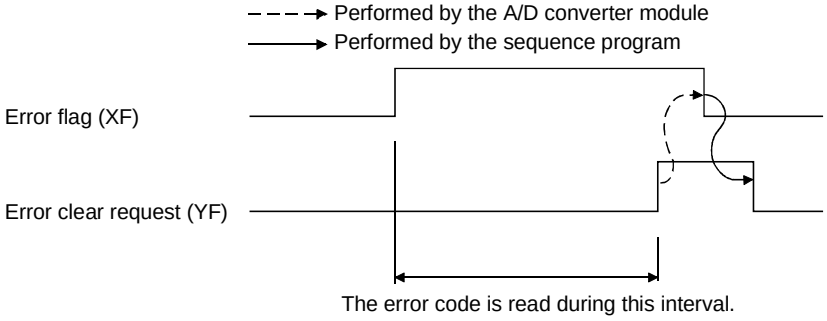
I/O signals for the A/D converter modules are explained in detail below.

(1) Input signals

Device No.	Signal Name	Description
X0	Module READY	(1) When the PLC CPU is powered on or reset, this signal turns on once the preparation for A/D conversion has been completed, and A/D conversion processing is then performed. (2) When the Module READY signal is off, A/D conversion processing is not performed. Module READY (X0) turns off in the following situations: • During offset/gain setting mode • When the A/D converter module has a watchdog timer error ＊1
X1	Temperature drift compensation flag	(1) When A/D conversion processing is being performed with the temperature drift compensation function on, the flag indicating temperature drift compensation status (X1) turns ON.
X8	High resolution mode status flag	(1) This turns ON when in high resolution mode.
X9	Operating condition setting completed flag	(1) This is used as an interlock condition for turning the operating condition setting request (Y9) ON/OFF when the setting for A/D conversion enable/disable (buffer memory address 0: Un\G0) is changed. (2) When the operating condition setting completed flag (X9) is OFF, A/D conversion processing is not performed. Under the following conditions, the operating condition setting completed flag (X9) turns OFF. • When Module READY (X0) is OFF • When operating condition setting request (Y9) is ON 

＊1 A watchdog timer error occurs when the program calculations are not completed within the scheduled time due to malfunctions of A/D converter module hardware. When a watchdog timer error occurs, the RUN LED for the A/D converter module turns off.

<table>
<tr><th>Device No.</th><th>Signal Name</th><th>Description</th></tr>
<tr><td rowspan="2">XA</td><td rowspan="2">Offset/gain setting mode flag</td><td>[In offset/gain setting mode]
(1) This is used as an interlock condition for setting the offset/gain request (YA) to ON/OFF when registering the value after adjustment of the offset/gain settings have been completed.
(2) See Section 4.6 regarding the offset/gain settings.
 
</td></tr>
<tr><td>[In normal mode]
(1) This signal is used as an interlock condition to turn ON/OFF the User range writing request (YA) when the user range is restored.
(2) Refer to Chapter 7 for the user range restoration.
 
</td></tr>
</table>

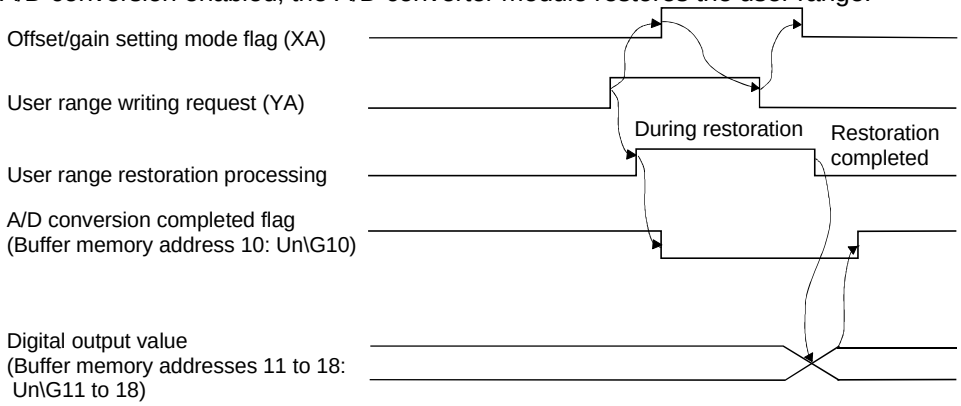
Device No.	Signal name	Description
XB	Channel change completed flag	(1) This is used as an interlock condition for setting the channel change request (YB) to ON/OFF when changing the channel for which the offset/gain settings are to be performed. (2) See Section 4.6 regarding the offset/gain settings. 
XD	Maximum value/minimum value reset completed flag	(1) This turns ON when the maximum and minimum values stored in buffer memory addresses 30 to 45 (Un\G30 to Un\G45) are reset by setting the maximum value/minimum value reset request (YD) to ON. 
XE	A/D conversion completed flag	(1) This turns ON when conversion for all of the channels that are conversion enabled has been completed.
XF	Error flag	(1) The error flag turns ON when a write error occurs. (2) To clear the error code, set the error clear request (YF) to ON. 

(2) Output signals

Device No.	Signal name	Description
Y9	Operating condition setting request	(1) This turns ON when A/D conversion is enabled/disabled, or when averaging processing specification, the settings for the average time or number of times (when averaging processing is specified) is enabled. (2) See the X9 column for ON/OFF timing.
YA	User range write request	[In offset/gain setting mode] (1) This turns ON when the value for the adjusted offset/gain settings are registered in the A/D converter module. (2) See the XA column for ON/OFF timing. See Section 4.6 for offset/gain settings.
		[In normal mode] (1) This signal turns ON when the user range is restored. (2) Refer to the field of XA for the ON/OFF timing. Refer to Chapter 7 for user range restoration.
YB	Channel change request	(1) This turns ON when changing the channel for which offset/gain settings are to be performed. (2) See the XB column for ON/OFF timing. See Section 4.6 for offset/gain settings.
YD	Maximum value/ minimum value reset request	(1) The maximum and minimum values stored in buffer memory addresses 30 to 45 (Un\G30 to Un\G45) are cleared by setting the maximum and minimum value reset request (YD) to ON. (2) See the XD column for ON/OFF timing.
YF	Error clear request	(1) This turns ON when a write error is cleared. (2) See the XF column for ON/OFF timing.

POINT

When the User range writing request (YA) is turned ON in the normal mode with A/D conversion enabled, the A/D converter module restores the user range.



During user range restoration: A/D conversion stop, A/D conversion completed flag (buffer memory addresses 10: Un\G10) OFF, digital output value held as previously

After user range restoration: A/D conversion resumed (when user range setting is used, A/D conversion is resumed at the restored offset/gain setting value.)

3.4 Buffer Memory

The detailed explanation of the buffer memory in Section 3.4.4 and later is based on the 8-channel analog input (CH. 1 to CH. 8) Q68ADV/Q68ADI.

3.4.1 Buffer memory assignment (Q64AD)

This section describes the assignment of the Q64AD buffer memory.

Table 3.4 Buffer memory assignment (Q64AD)

Address		Description	R/W ＊1	Address		Description	R/W ＊1
Hexadecimal	Decimal			Hexadecimal	Decimal		
0H	0	A/D conversion enable/disable setting	R/W	26H	38	System area	—
1H	1	CH1 Average time/average number of times	R/W	to	to		
2H	2	CH2 Average time/average number of times	R/W	9DH	157		
3H	3	CH3 Average time/average number of times	R/W	9EH	158	Mode switching setting	R/W
4H	4	CH4 Average time/average number of times	R/W	9FH	159		R/W
5H	5	System area	—	A0H	160	System area	—
to	to			to	to		
8H	8			C7H	199		
9H	9	Averaging process setting	R/W	C8H	200	Pass data classification setting ＊2	R/W
AH	10	A/D conversion completed flag	R	C9H	201	System area	—
BH	11	CH1 Digital output value	R	CAH	202	CH1 Industrial shipment settings offset value ＊2	R/W
CH	12	CH2 Digital output value	R	CBH	203	CH1 Industrial shipment settings gain value ＊2	R/W
DH	13	CH3 Digital output value	R	CCH	204	CH2 Industrial shipment settings offset value ＊2	R/W
EH	14	CH4 Digital output value	R	CDH	205	CH2 Industrial shipment settings gain value ＊2	R/W
FH	15	System area	—	CEH	206	CH3 Industrial shipment settings offset value ＊2	R/W
to	to			CFH	207	CH3 Industrial shipment settings gain value ＊2	R/W
12H	18			D0H	208	CH4 Industrial shipment settings offset value ＊2	R/W
13H	19	Error code	R	D1H	209	CH4 Industrial shipment settings gain value ＊2	R/W
14H	20	Setting range (CH1 to CH4)	R	D2H	210	CH1 User range settings offset value ＊2	R/W
15H	21	System area	—	D3H	211	CH1 User range settings gain value ＊2	R/W
16H	22	Offset/gain setting mode Offset specification	R/W	D4H	212	CH2 User range settings offset value ＊2	R/W
17H	23	Offset/gain setting mode Gain specification	R/W	D5H	213	CH2 User range settings gain value ＊2	R/W
18H	24	System area	—	D6H	214	CH3 User range settings offset value ＊2	R/W
to	to			D7H	215	CH3 User range settings gain value ＊2	R/W
1DH	29			D8H	216	CH4 User range settings offset value ＊2	R/W
1EH	30	CH1 Maximum value	R/W	D9H	217	CH4 User range settings gain value ＊2	R/W
1FH	31	CH1 Minimum value	R/W				
20H	32	CH2 Maximum value	R/W				
21H	33	CH2 Minimum value	R/W				
22H	34	CH3 Maximum value	R/W				
23H	35	CH3 Minimum value	R/W				
24H	36	CH4 Maximum value	R/W				
25H	37	CH4 Minimum value	R/W				

＊1 Indicates whether reading and writing to/from a sequence program are enabled.
R : Read enabled
W : Write enabled

＊2 Areas used to restore the user range settings offset/gain values when online module change is made.
Refer to chapter 7 for details of online module change.

3.4.2 Buffer memory assignment (Q68ADV)

This section describes the assignment of the Q68ADV buffer memory.

Table 3.5 Buffer memory assignment (Q68ADV)

Address		Description	R/W ＊1	Address		Description	R/W ＊1
Hexadecimal	Decimal			Hexadecimal	Decimal		
0H	0	A/D conversion enable/disable setting	R/W	2EH	46	System area	—
1H	1	CH1 Average time/average number of times	R/W	to	to		
2H	2	CH2 Average time/average number of times	R/W	9DH	157		
3H	3	CH3 Average time/average number of times	R/W	9EH	158	Mode switching setting	R/W
4H	4	CH4 Average time/average number of times	R/W	9FH	159		R/W
5H	5	CH5 Average time/average number of times	R/W	A0H	160	System area	—
6H	6	CH6 Average time/average number of times	R/W	to	to		
7H	7	CH7 Average time/average number of times	R/W	C9H	201		
8H	8	CH8 Average time/average number of times	R/W	CAH	202	CH1 Industrial shipment settings offset value ＊2	R/W
9H	9	Averaging process setting	R/W	CBH	203	CH1 Industrial shipment settings gain value ＊2	R/W
AH	10	A/D conversion completed flag	R	CCH	204	CH2 Industrial shipment settings offset value ＊2	R/W
BH	11	CH1 Digital output value	R	CDH	205	CH2 Industrial shipment settings gain value ＊2	R/W
CH	12	CH2 Digital output value	R	CEH	206	CH3 Industrial shipment settings offset value ＊2	R/W
DH	13	CH3 Digital output value	R	CFH	207	CH3 Industrial shipment settings gain value ＊2	R/W
EH	14	CH4 Digital output value	R	D0H	208	CH4 Industrial shipment settings offset value ＊2	R/W
FH	15	CH5 Digital output value	R	D1H	209	CH4 Industrial shipment settings gain value ＊2	R/W
10H	16	CH6 Digital output value	R	D2H	210	CH5 Industrial shipment settings offset value ＊2	R/W
11H	17	CH7 Digital output value	R	D3H	211	CH5 Industrial shipment settings gain value ＊2	R/W
12H	18	CH8 Digital output value	R	D4H	212	CH6 Industrial shipment settings offset value ＊2	R/W
13H	19	Error code	R	D5H	213	CH6 Industrial shipment settings gain value ＊2	R/W
14H	20	Setting range (CH1 to CH4)	R	D6H	214	CH7 Industrial shipment settings offset value ＊2	R/W
15H	21	Setting range (CH5 to CH8)	R	D7H	215	CH7 Industrial shipment settings gain value ＊2	R/W
16H	22	Offset/gain setting mode Offset specification	R/W	D8H	216	CH8 Industrial shipment settings offset value ＊2	R/W
17H	23	Offset/gain setting mode Gain specification	R/W	D9H	217	CH8 Industrial shipment settings gain value ＊2	R/W
18H	24	System area	—	DAH	218	CH1 User range settings offset value ＊2	R/W
to	to			DBH	219	CH1 User range settings gain value ＊2	R/W
1DH	29			DCH	220	CH2 User range settings offset value ＊2	R/W
1EH	30	CH1 Maximum value	R/W	DDH	221	CH2 User range settings gain value ＊2	R/W
1FH	31	CH1 Minimum value	R/W	DEH	222	CH3 User range settings offset value ＊2	R/W
20H	32	CH2 Maximum value	R/W	DFH	223	CH3 User range settings gain value ＊2	R/W
21H	33	CH2 Minimum value	R/W	E0H	224	CH4 User range settings offset value ＊2	R/W
22H	34	CH3 Maximum value	R/W	E1H	225	CH4 User range settings gain value ＊2	R/W
23H	35	CH3 Minimum value	R/W	E2H	226	CH5 User range settings offset value ＊2	R/W
24H	36	CH4 Maximum value	R/W	E3H	227	CH5 User range settings gain value ＊2	R/W
25H	37	CH4 Minimum value	R/W	E4H	228	CH6 User range settings offset value ＊2	R/W
26H	38	CH5 Maximum value	R/W	E5H	229	CH6 User range settings gain value ＊2	R/W
27H	39	CH5 Minimum value	R/W	E6H	230	CH7 User range settings offset value ＊2	R/W
28H	40	CH6 Maximum value	R/W	E7H	231	CH7 User range settings gain value ＊2	R/W
29H	41	CH6 Minimum value	R/W	E8H	232	CH8 User range settings offset value ＊2	R/W
2AH	42	CH7 Maximum value	R/W	E9H	233	CH8 User range settings gain value ＊2	R/W
2BH	43	CH7 Minimum value	R/W				
2CH	44	CH8 Maximum value	R/W				
2DH	45	CH8 Minimum value	R/W				

＊1 Indicates whether reading and writing to/from a sequence program are enabled.
R : Read enabled
W : Write enabled

＊2 Areas used to restore the user range settings offset/gain values when online module change is made.
Refer to chapter 7 for details of online module change.

3.4.3 Buffer memory assignment (Q68ADI)

This section describes the assignment of the Q68ADI buffer memory.

Table 3.6 Buffer memory assignment (Q68ADI)

Address		Description	R/W ＊1	Address		Description	R/W ＊1
Hexadecimal	Decimal			Hexadecimal	Decimal		
0H	0	A/D conversion enable/disable setting	R/W	2EH	46	System area	—
1H	1	CH1 Average time/average number of times	R/W	to	to		
2H	2	CH2 Average time/average number of times	R/W	9DH	157		
3H	3	CH3 Average time/average number of times	R/W	9EH	158	Mode switching setting	R/W
4H	4	CH4 Average time/average number of times	R/W	9FH	159		R/W
5H	5	CH5 Average time/average number of times	R/W	A0H	160	System area	—
6H	6	CH6 Average time/average number of times	R/W	to	to		
7H	7	CH7 Average time/average number of times	R/W	C9H	201		
8H	8	CH8 Average time/average number of times	R/W	CAH	202	CH1 Industrial shipment settings offset value ＊2	R/W
9H	9	Averaging process setting	R/W	CBH	203	CH1 Industrial shipment settings gain value ＊2	R/W
AH	10	A/D conversion completed flag	R	CCH	204	CH2 Industrial shipment settings offset value ＊2	R/W
BH	11	CH1 Digital output value	R	CDH	205	CH2 Industrial shipment settings gain value ＊2	R/W
CH	12	CH2 Digital output value	R	CEH	206	CH3 Industrial shipment settings offset value ＊2	R/W
DH	13	CH3 Digital output value	R	CFH	207	CH3 Industrial shipment settings gain value ＊2	R/W
EH	14	CH4 Digital output value	R	D0H	208	CH4 Industrial shipment settings offset value ＊2	R/W
FH	15	CH5 Digital output value	R	D1H	209	CH4 Industrial shipment settings gain value ＊2	R/W
10H	16	CH6 Digital output value	R	D2H	210	CH5 Industrial shipment settings offset value ＊2	R/W
11H	17	CH7 Digital output value	R	D3H	211	CH5 Industrial shipment settings gain value ＊2	R/W
12H	18	CH8 Digital output value	R	D4H	212	CH6 Industrial shipment settings offset value ＊2	R/W
13H	19	Error code	R	D5H	213	CH6 Industrial shipment settings gain value ＊2	R/W
14H	20	Setting range (CH1 to CH4)	R	D6H	214	CH7 Industrial shipment settings offset value ＊2	R/W
15H	21	Setting range (CH5 to CH8)	R	D7H	215	CH7 Industrial shipment settings gain value ＊2	R/W
16H	22	Offset/gain setting mode Offset specification	R/W	D8H	216	CH8 Industrial shipment settings offset value ＊2	R/W
17H	23	Offset/gain setting mode Gain specification	R/W	D9H	217	CH8 Industrial shipment settings gain value ＊2	R/W
18H	24	System area	—	DAH	218	CH1 User range settings offset value ＊2	R/W
to	to			DBH	219	CH1 User range settings gain value ＊2	R/W
1DH	29			DCH	220	CH2 User range settings offset value ＊2	R/W
1EH	30	CH1 Maximum value	R/W	DDH	221	CH2 User range settings gain value ＊2	R/W
1FH	31	CH1 Minimum value	R/W	DEH	222	CH3 User range settings offset value ＊2	R/W
20H	32	CH2 Maximum value	R/W	DFH	223	CH3 User range settings gain value ＊2	R/W
21H	33	CH2 Minimum value	R/W	E0H	224	CH4 User range settings offset value ＊2	R/W
22H	34	CH3 Maximum value	R/W	E1H	225	CH4 User range settings gain value ＊2	R/W
23H	35	CH3 Minimum value	R/W	E2H	226	CH5 User range settings offset value ＊2	R/W
24H	36	CH4 Maximum value	R/W	E3H	227	CH5 User range settings gain value ＊2	R/W
25H	37	CH4 Minimum value	R/W	E4H	228	CH6 User range settings offset value ＊2	R/W
26H	38	CH5 Maximum value	R/W	E5H	229	CH6 User range settings gain value ＊2	R/W
27H	39	CH5 Minimum value	R/W	E6H	230	CH7 User range settings offset value ＊2	R/W
28H	40	CH6 Maximum value	R/W	E7H	231	CH7 User range settings gain value ＊2	R/W
29H	41	CH6 Minimum value	R/W	E8H	232	CH8 User range settings offset value ＊2	R/W
2AH	42	CH7 Maximum value	R/W	E9H	233	CH8 User range settings gain value ＊2	R/W
2BH	43	CH7 Minimum value	R/W				
2CH	44	CH8 Maximum value	R/W				
2DH	45	CH8 Minimum value	R/W				

＊1 Indicates whether reading and writing to/from a sequence program are enabled.
R : Read enabled
W : Write enabled

＊2 Areas used to restore the user range settings offset/gain values when online module change is made.
Refer to chapter 7 for details of online module change.

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3.4.4 A/D conversion enable/disable setting (buffer memory address 0: Un\G0)

(1) Sets whether the output of an A/D conversion value is enabled or disabled for each channel.

(2) It is necessary to set the operating condition setting request (Y9) to ON/OFF in order to enable the A/D conversion enable/disable setting. (See Section 3.2.2.)

(3) By default, A/D conversion is enabled for all channels.

(4) In the case of the Q64AD module, b4 to b7 (CH5 to CH8) become invalid.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

For the Q64AD, information for b4 to b15 is fixed at 0,and
for the Q68ADV (I), information for b8 to b15 is fixed at 0.

0 : A/D conversion enabled
1 : A/D conversion disabled

Example

When the channels used for A/D conversion are 1, 3, 5 and 8, 006A$_H$ (106) is stored in buffer memory address 0 (Un\G0).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	006A$_H$ (106)
								CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	
								0		0		6		A		

3.4.5 CH□ average time/average number of times (buffer memory addresses 1 to 8: Un\G1 to Un\G8)

(1) Sets the average time or average number of times for each channel for which averaging processing was specified.

(2) The setting range is as shown below:
Averaging processing by the number of times: 4 to 62500
Averaging processing by time: 2 to 5000 ms

(3) Zero is set as the default.

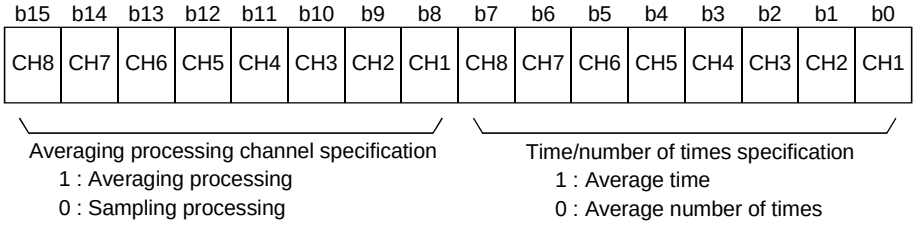
3.4.6 Averaging processing setting (buffer memory address 9: Un\G9)

(1) When selecting sampling processing or averaging processing, write the setting to buffer memory address 9 (Un\G9).

(2) When averaging processing is selected, select average time or average number of times.

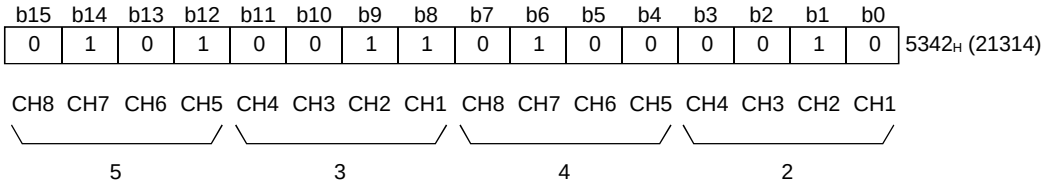
(3) By default, sampling processing is set for all channels.

(4) In the case of the Q64AD module, b4 to b7 and b12 to b15 (CH5 to CH8) are invalid.



Example

To average channels 1 and 5 for the set number of times and channels 2 and 7 for the set amount of time, and to sample-process other channels, store 5342_H (21314) in buffer-memory address 9 (Un\G9).



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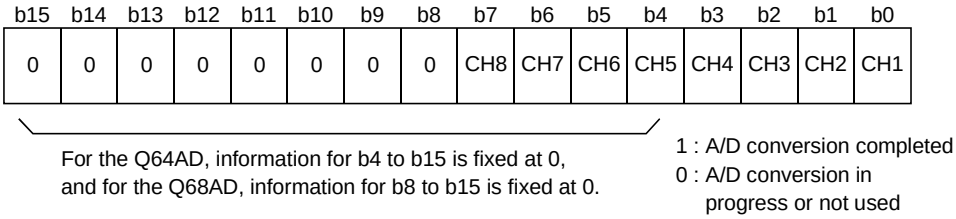
3.4.7 A/D conversion completed flag (buffer memory address 10: Un\G10)

(1) When A/D conversion for the channels enabled for conversion is complete, the A/D conversion completed flag is set to 1. The A/D conversion completed flag (XE) is set to ON when the conversion for all A/D conversion enabled channels is complete.

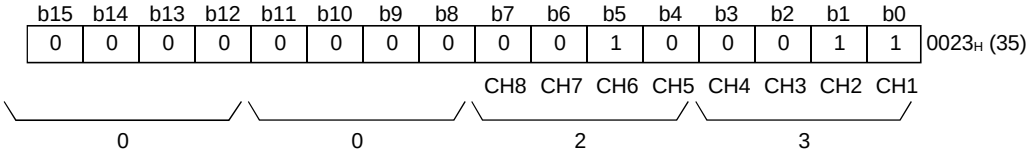
(2) When the operating condition setting request (Y9) is set to ON, the flag returns to the default setting of 0 and changes to 1 when A/D conversion is complete.

(3) In the case of the Q64AD module, b4 to b7 (CH5 to CH8) are invalid.



Example

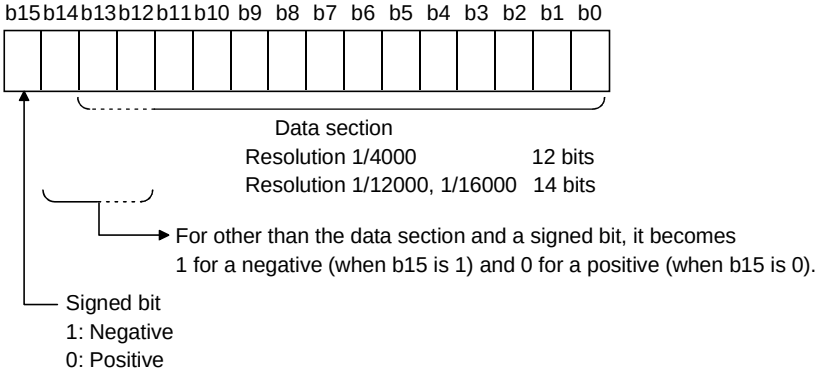
When A/D conversion is enabled for channels 1, 2 and 6 and all conversions for these channels are complete, 0023_H (35) is stored in buffer-memory address 10 (Un\G10).



3.4.8 Digital output values (buffer memory addresses 11 to 18: Un\G11 to Un\G18)

(1) The digital output values after A/D conversion are stored in the buffer memory addresses from 11 to 18 (Un\G11 to Un\G18) for each channel.

(2) The digital output values are expressed with 16-bit signed binary values.



3.4.9 Write data error codes (buffer memory address 19: Un\G19)

(1) The error codes generated by the A/D converter modules are stored here.

(2) See Section 8.1 for the details of the error codes.

3.4.10 Setting ranges (buffer memory addresses 20, 21: Un\G20, Un\G21)

(1) These areas are used to confirm the setting ranges of the A/D converter module.

(2) The setting values for CH1 to CH4 are stored in buffer memory address 20 (Un\G20) and setting values for CH5 to CH8 are stored in buffer memory address 21 (Un\G21). In the case of the Q64AD module, buffer memory address 21 (Un\G21) is invalid.

	b15 to b12	b11 to b8	b7 to b4	b3 to b0
Un\G20	CH4	CH3	CH2	CH1
Un\G21	CH8	CH7	CH6	CH5

The setting values are as follows.

Input range	Setting value
4 to 20 (mA)	0H
0 to 20 (mA)	1H
1 to 5 (V)	2H
0 to 5 (V)	3H
–10 to 10 (V)	4H
0 to 10 (V)	5H
User range setting	FH

(3) Default setting is 0.
When the setting for Q68ADV is 0, the analog input range operates between 0 to 10V.
(When the setting is 5H, the analog input range will be the same as above.)

3.4.11 Offset/gain setting mode (buffer memory addresses 22, 23: Un\G22, Un\G23)

(1) Specifies the channel to be adjusted for the offset/gain settings.

(2) The channel for which the offset is to be adjusted is specified in buffer memory address 22 (Un\G22) and the channel for which the gain is to be adjusted is specified in buffer memory address 23 (Un\G23).

(3) Although it is possible to set multiple channels at the same time, set the offset and gain separately (buffer memory addresses 22 and 23: Set either Un\G22 or Un\G23 to 0). If both are set at the same time, an offset/gain setting mode error (error code 500) occurs.

(4) For Q64AD, b4 to b7 (information for CH5 to CH8) are invalid.

(5) See Section 4.6 for the details of the offset/gain settings.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G22 (Offset specification)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Un\G23 (Gain specification)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

1 : Channel to be set
0 : Invalid

3.4.12 Maximum and minimum values storage area (buffer memory addresses 30 to 45: Un\G30 to Un\G45)

(1) The maximum and minimum values of the converted digital value for each channel are stored.

(2) The stored values for all channels will be cleared to 0 when the operating condition setting request (Y9) is set to ON and the setting is changed or when the maximum and minimum values reset request (YD) is set to ON.

(3) The maximum and minimum values are stored for each sample processing time (measurement), even with channels for which averaging processing is specified.

3.4.13 Mode switching setting (buffer memory addresses 158, 159: Un\G158, Un\G159)

(1) Set the values of the mode to which you want to switch.

(2) After setting the values, turning the operation condition setting request (Y9) from OFF to ON switches to that mode.

(3) When mode switching is performed, this area is cleared to zero and the operating condition setting completed flag (X9) turns OFF.
After confirming that the operating condition setting completed flag (X9) has turned OFF, turn OFF the operation condition setting request (Y9).

Mode to be switched to	Set values	
	Buffer memory address 158	Buffer memory address 159
Normal mode	0964H	4144H
Offset/gain setting mode	4144H	0964H

POINT

If the values written are other than the above, mode switching is not performed and only the operating condition is changed.

3.4.14 Pass data classification setting (buffer memory addresses 200: Un\G200) (Q64AD only)

(1) Areas used to restore the user range settings offset/gain values when online module change is made.
Refer to chapter 7 for details of online module change.

(2) Specify whether the offset/gain values to be saved/restored are voltages or currents when saving/restoring the offset/gain values of the user range setting.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data in b4 to b15 are fixed to 0.

1: Current specified
0: Voltage specified

POINT

Refer to Section 4.6 for the offset/gain value setting method.

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3.4.15 Industrial shipment settings and user range settings offset/gain values (buffer memory addresses 202 to 233: Un\G202 to Un\G233)

(1) Areas used to restore the user range settings offset/gain values when online module change is made.
Refer to chapter 7 for details of online module change.

(2) When the offset/gain values of the user range setting are restored, the used data are stored.
The data are stored (saved) when:
- Initial setting write is performed by the utility;
- The operating condition is set (Y9 turns from OFF to ON ∗1); or
- The offset/gain values are written in the offset/gain setting mode (YA turns from OFF to ON).

∗1: The data are not saved when values have been written to the mode switching setting area (buffer memory addresses 158, 159: Un\G158, Un\G159).

(3) When restoring the offset/gain values of the user range setting, set the data saved here similarly into the corresponding area of the module where the data will be restored.

(4) Buffer memory saving recording procedure for online module change
1) Set the pass data classification setting ∗ (buffer memory addresses 200: Un\G200).
2) Turn the operation condition setting request (Y9) from OFF to ON.
3) Compare the offset/gain values of the industrial shipment settings and user range settings (buffer memory addresses 202 to 233: Un\G202 to Un\G233) with the range reference values. Refer to Section 7.4 for the range reference values.
4) If the values are proper, record the offset/gain values of the pass data classification setting ∗, industrial shipment settings and user range settings.

∗: The Q68ADV/Q68ADI does not require the setting and recording of the pass data classification setting.

POINT
Refer to Section 4.6 for the offset/gain value setting method.

4 SETUP AND PROCEDURES BEFORE OPERATION

4.1 Handling Precautions

(1) Do not drop the module or subject it to heavy impact.

(2) Do not remove the PCB of the module from its case. Doing so may cause the module to fail.

(3) Be careful not to let foreign particles such as swarf or wire chips enter the module. They may cause a fire, mechanical failure or malfunction.

(4) The top surface of the module is covered with a protective film to prevent foreign objects such as wire burrs from entering the module during wiring. Do not remove this film until the wiring is complete. Before operating the system, be sure to remove the film to provide adequate ventilation.

(5) Tighten the terminal screws using torque within the following ranges. Loose screws may cause short circuits, mechanical failures or malfunctions.

Screw location	Clamping torque range
Module mounting screws (M3 screws)	36 to 48 N · cm
Terminal block screws (M3 screws)	42 to 58 N · cm
Terminal block mounting screws (M3.5 screws)	66 to 89 N · cm

(6) To mount the module on the base, securely insert the module fastening latch into the fastening hole on the base. Improper installation may result in a module malfunction, or may cause the module to fall off.

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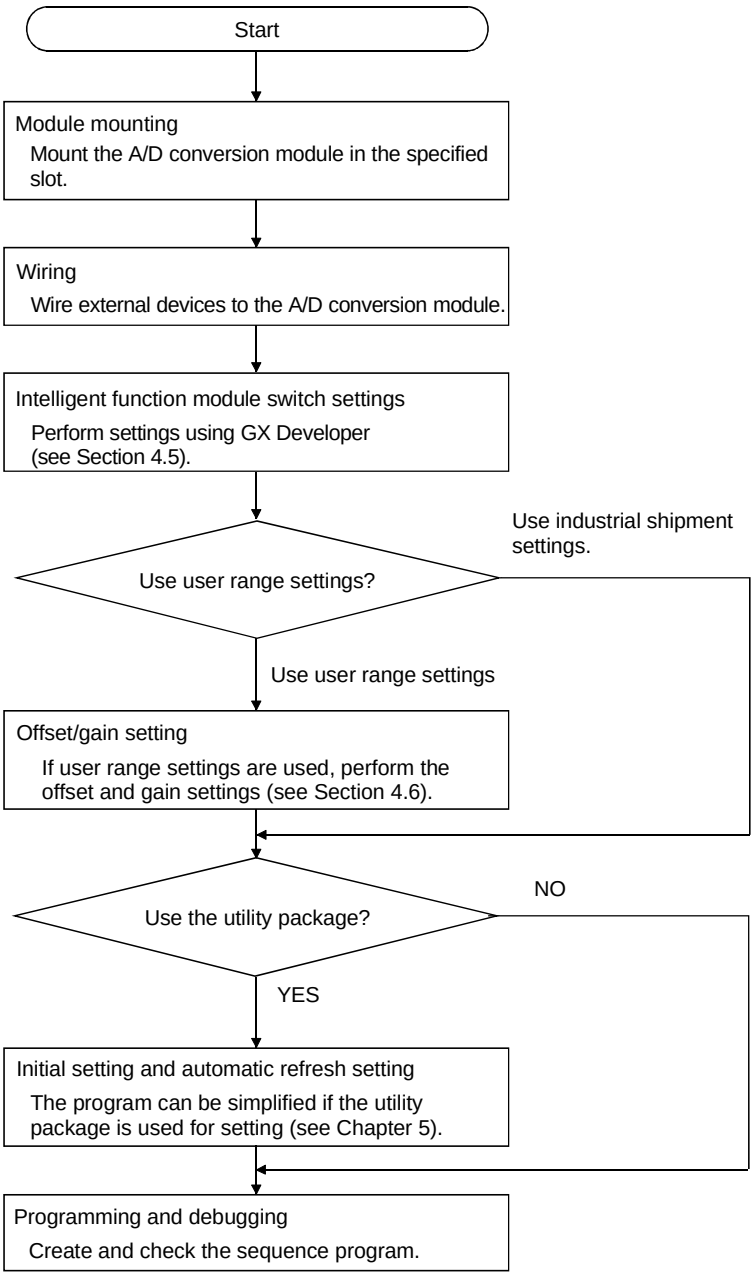
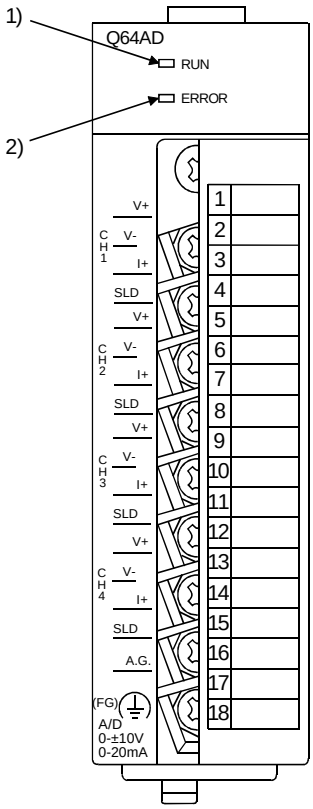
4.2 Setup and Procedures before Operation



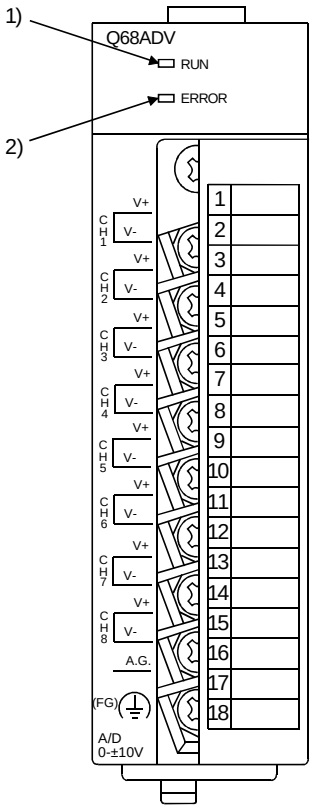
4.3 Part Identification Nomenclature

The name of each part of the A/D converter module is listed below.

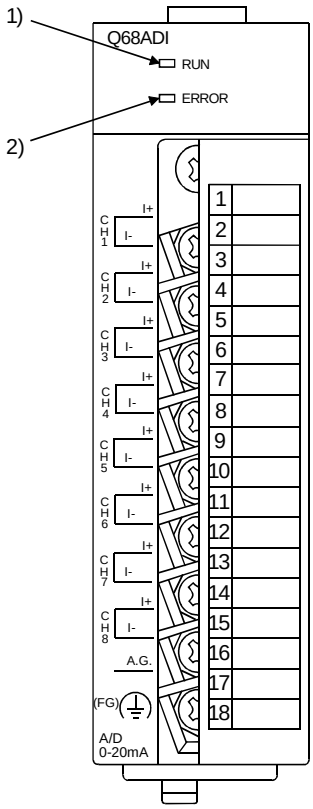
Q64AD



Q68ADV



Q68ADI



Number	Name and appearance	Description
1)	RUN LED	Displays the operating status of the A/D converter module. On : Normal operation Flashing : During offset/gain setting mode Off : 5V power switched off, watchdog timer error occurred, or online module change enabled
2)	ERROR LED	Displays the error status of the A/D converter module. On : Error ✻ Off : Normal operation Flashing : Error in switch settings Switch No. 5 of the intelligent function module has been set to a value other than zero "0".

✻ Check the error code for details.

Terminal number	Signal name					
	Q64AD		Q68ADV		Q68ADI	
1	CH1	V +	CH1	V +	CH1	I +
2		V –		V –		I –
3		I +	CH2	V +	CH2	I +
4		SLD		V –		I –
5	CH2	V +	CH3	V +	CH3	I +
6		V –		V –		I –
7		I +	CH4	V +	CH4	I +
8		SLD		V –		I –
9	CH3	V +	CH5	V +	CH5	I +
10		V –		V –		I –
11		I +	CH6	V +	CH6	I +
12		SLD		V –		I –
13	CH4	V +	CH7	V +	CH7	I +
14		V –		V –		I –
15		I +	CH8	V +	CH8	I +
16		SLD		V –		I –
17	A.G. (ANALOG GND)					
18	FG					

4.4 Wiring

The wiring precautions and examples of module connection are provided below.

4.4.1 Wiring precautions

In order to optimize the functions of the A/D converter module and ensure system reliability, external wiring that is protected from noise is required.
Please observe the following precautions for external wiring:

(1) Use separate cables for the AC control circuit and the external input signals of the Q64AD/Q68ADV(I) to avoid the influence of the AC side surges and inductions.

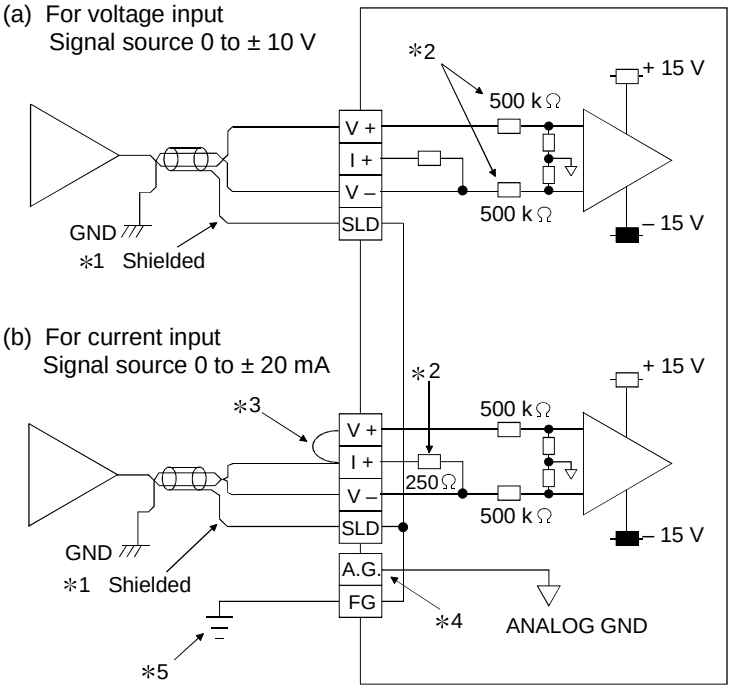
(2) Do not mount the cables close to or bundle them with the main circuit line, a high-voltage cable or a load cable from other than the PLC. This may increase the effects of noise, surges and induction.

(3) Perform an one-point grounding for shielded lines and the shields of sealed cables.

(4) A solderless terminal with insulating sleeve cannot be used for the terminal block. Covering the cable-connection portion of the solderless terminal with a marked tube or an insulation tube is recommended.

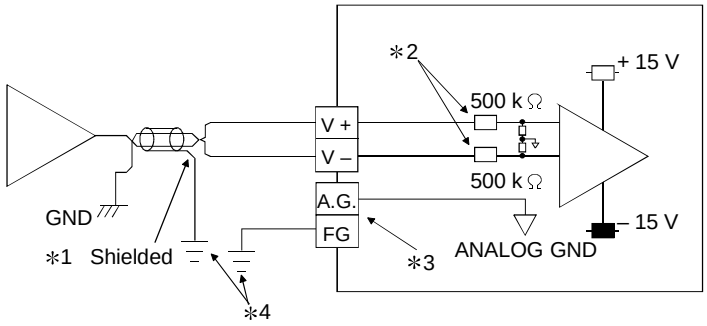
4.4.2 External wiring

(1) Q64AD



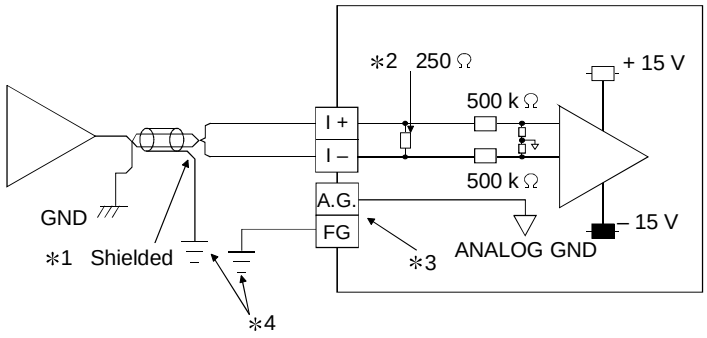
∗1 Use a twisted two core shielded wire for the power wire.
∗2 Shows input resistance of Q64AD.
∗3 If current input, always connect to (V +) and (I +) terminals.
∗4 "A.G." terminal does not normally require wiring. However, it can be used as GND for compatible equipment ground under the following conditions.
(1) When there is a difference in polarity between "A.G" and "GND for compatible equipment".
(2) As an alternative for 0 V input when only the + side is open on a ± wire.
∗5 Always use a ground. In addition, ground the FB of the power supply module.

(2) Q68ADV



∗1 Use a twisted two core shielded wire for the power wire.
∗2 Shows input resistance of Q68ADV.
∗3 "A.G." terminal does not normally require wiring. However, it can be used as GND for compatible equipment ground under the following conditions.
(1) When there is a difference in polarity between "A.G" and "GND for compatible equipment".
(2) As an alternative for 0 V input when only the + side is open on a ± wire.
∗4 Always use a ground. In addition, ground the FB of the power supply module.

(3) Q68ADI



∗1 Use a twisted two core shielded wire for the power wire.
∗2 Shows input resistance of Q68ADI.
∗3 "A.G." terminal does not normally require wiring. However, it can be used as GND for compatible equipment ground under the following conditions.
(1) When there is a difference in polarity between "A.G" and "GND for compatible equipment".
∗4 Always use a ground. In addition, ground the FB of the power supply module.

4.5 Switch Setting for Intelligent Function Module

The settings for the intelligent function module are performed using the I/O assignment settings for GX Developer.

(1) Setting item

The intelligent function module switches consist of switches 1 to 5 and are set using 16 bit data. When the intelligent function module switches are not set, the default value for switches 1 to 5 is 0.

Table 4.1 Switch setting item

<table>
<tr><th></th><th>Setting item</th></tr>
<tr><td>Switch 1</td><td>Input range setting
□□□□ H
CH4 CH3 CH2 CH1</td><td rowspan="2"><table>
<tr><th>Analog input range</th><th>Input range setting value</th></tr>
<tr><td>4 to 20 mA</td><td>0H ＊1</td></tr>
<tr><td>0 to 20 mA</td><td>1H</td></tr>
<tr><td>1 to 5 V</td><td>2H</td></tr>
<tr><td>0 to 5 V</td><td>3H</td></tr>
<tr><td>– 10 to 10 V</td><td>4H</td></tr>
<tr><td>0 to 10 V</td><td>5H</td></tr>
<tr><td>User range setting</td><td>FH</td></tr>
</table></td></tr>
<tr><td>Switch 2</td><td>Input range setting
□□□□ H
CH8 CH7 CH6 CH5</td></tr>
<tr><td>Switch 3</td><td colspan="2">Not used</td></tr>
<tr><td>Switch 4</td><td colspan="2">□□□□ H
00H : With temperature drift correction
01 to FFH (numeric value other than 00H)*: Without temperature drift correction
0H : Normal resolution mode
1 to FH (numeric value other than 0H)*: High resolution mode
0H : Normal mode (A/D conversion processing)
1 to FH (numeric value other than 0H)*: Offset/gain setting mode</td></tr>
<tr><td>Switch 5</td><td colspan="2">0 : Fixed</td></tr>
</table>

＊ Setting any value within the setting range will provide the same operation.
When the setting range is 1 to FH, set 1 for example.

Depending on the type of module used, the settings for A/D unit input range are shown below.

- Q64AD · · · · · ·0H to 5H, FH
- Q68ADV · · · · ·0H, 2H to 5H, FH

＊1 When the setting is 0H, the input operating range will be 0 t o 10 V.

- Q68ADI · · · · · ·0H, 1H, FH

POINT

(1) If the offset/gain setting mode is set using intelligent function module switch 4, other settings by switch 4 (settings for resolution mode and temperature drift compensation) will be ignored.

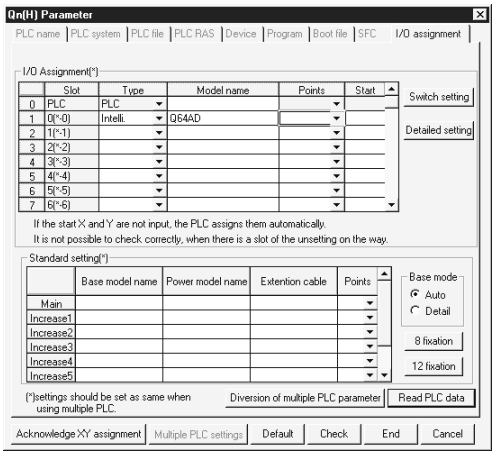
(2) Setting of the offset/gain setting mode differs from function version A to function version B. (Refer to Appendix 1.3)
Perform the offset/gain settings after checking the RUN LED flashes in offset/gain setting mode. If the RUN LED does not flash, check to see if the switch 4 setting is correct.

(3) Since the digital output value will differ considerably, depending on the resolution mode setting, thoroughly check the settings for the intelligent function module switches before performing the digital output processing.
Example) Digital output value when the setting range is -10 to 10 V and a 10 V analog value is added.

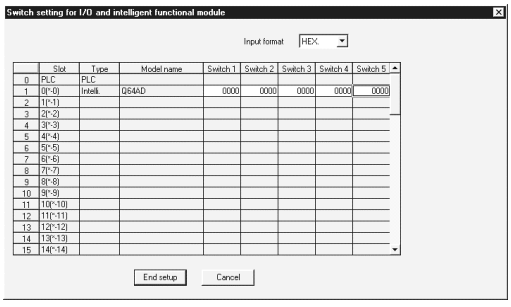
	In normal resolution mode	In high resolution mode
Digital output value	Approximately 4000	Approximately 16000

(2) Operating procedure

Start the settings with GX Developer I/O assignment setting screen.



(a) I/O assignment setting screen
Set the following for the slot in which the A/D converter module is mounted.
The type setting is required; set other items as needed.
Type : Select "intelli."
Model name : Enter the module model name.
Points : Select 16 points.
Start XY : Enter the start I/O number for the A/D converter module.
Detail setting: Specify the control PLC for the A/D converter module.
It is unnecessary to set the "Error time output mode" or "H/W error time PLC operation mode" since these settings are invalid for the A/D converter module.

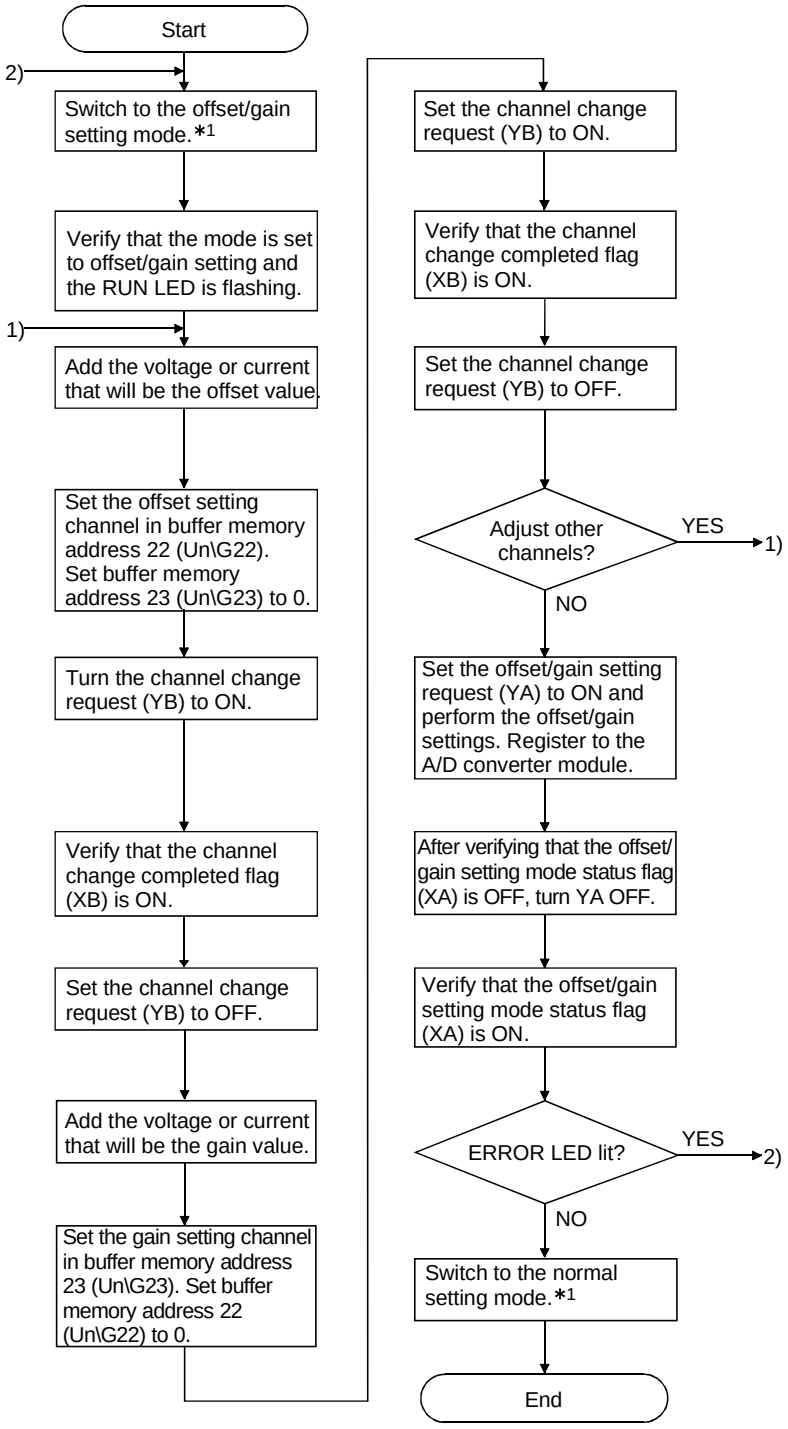


(b) Switch setting for intelligent function module screen
Click on [Switch setting] on the I/O assignment setting screen to display the screen shown at left, then set switches 1 to 5.
The switches can easily be set if values are entered in hexadecimal. Change the entry format to hexadecimal and then enter the values.

4.6 Offset/Gain Settings

When the user range setting is used, perform the offset and gain settings according to the following procedure.
When the industrial shipment setting is used, offset/gain setting is not necessary.
If the utility package is installed, perform the offset/gain settings according to the procedure described in Section 5.6.2.

(1) Offset/gain setting procedure



*1 The mode switching (normal mode to offset/gain setting mode to normal mode) method is given below.
- Dedicated instruction (G.OFFGAN) ..... Refer to Section 4.6 (2), (a)
- Setting made to mode switching setting (buffer memory addresses 158, 159: Un\G158, Un\G159) and turning the operation condition setting request (Y9) from OFF to ON ..... Refer to Section 4.6 (2), (b)
- Intelligent function module switch setting ..... Refer to Section 4.5, Section 4.6 (2), (c) (After intelligent function module switch setting, reset the PLC CPU or switch power OFF, then ON.)

POINT

(1) Perform the offset/gain settings in the range that satisfies the conditions specified in Section 3.1.2, (1) and (2).
When the setting exceeds this range, the maximum resolution or total accuracy may not be within the range indicated in the performance specification.

(2) Perform the offset/gain settings separately for each channel. If channels are set in buffer memory addresses 22 (Un\G22) and 23 (Un\G23) at the same time, an error will occur and the ERROR LED will be lit.

(3) After the offset/gain settings are completed, verify that the offset and gain values have been set correctly under actual usage conditions.

(4) The offset and gain values are stored into the E^2PROM and are not erased at power-off.

(5) At the time of offset/gain setting, turn ON the user range write request (YA) to write the values to the E^2PROM.
Data can be written to the E^2PROM up to 100 thousand times.
To prevent accidental write to the E^2PROM, an error will occur and the error code (buffer memory address 19: Un\G19) will be stored if write is performed 26 consecutive times.

(6) If an error (error code: 40□*1) occurs during offset/gain setting, re-set the correct offset/gain value.
The offset/gain value of the channel where the error has occurred is not written to the A/D converter module. (*1: □indicates the corresponding channel number.)

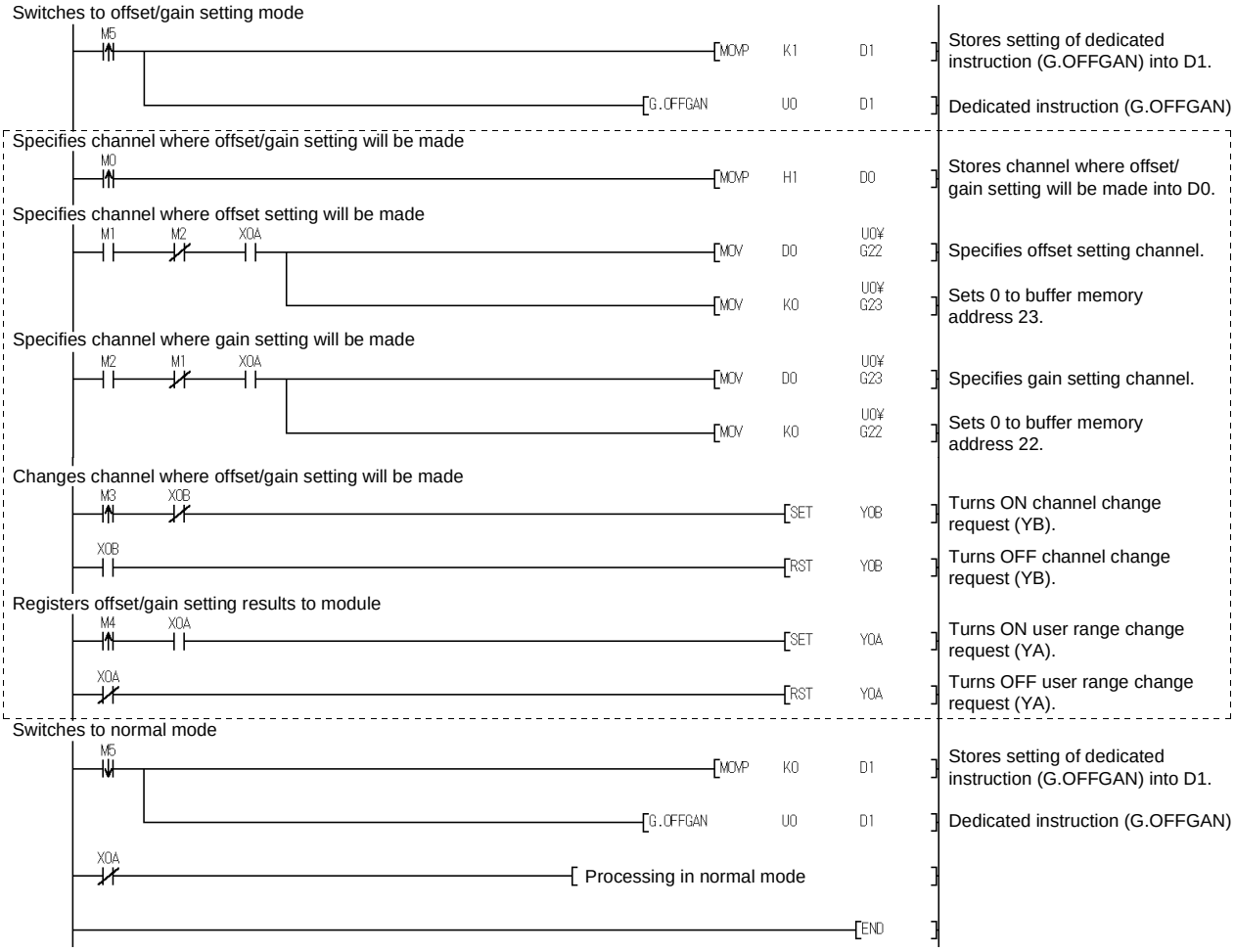
(7) Module Ready (X0) turns from OFF to ON when the offset/gain setting mode switches to the normal mode by the dedicated instruction (G.OFFGAN) or the setting of the mode switching setting (buffer memory addresses 158, 159: Un\G158, Un\G159).
Note that initial setting processing will be executed if there is a sequence program that makes initial setting when Module Ready (X0) turns ON.

(8) Buffer memory addresses 200 (Un\G200), 202 to 233 (Un\G202 to Un\G233) are the areas used to restore the user range settings offset/gain values when online module change is made.
Refer to chapter 7 for details of online module change.

(2) Program examples

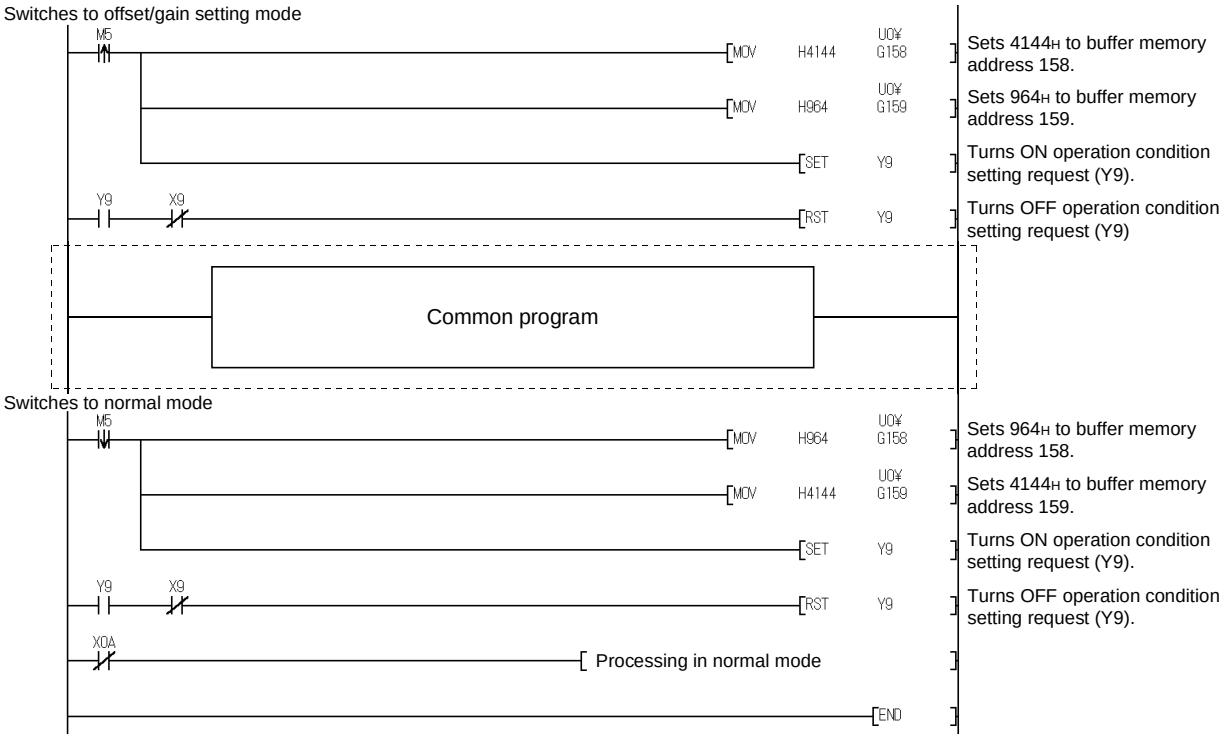
The program in the dotted area of (a) is common to (a), (b) and (c).
In this example, the I/O signals for the A/D converter module are X/Y0 to X/YF.
- Channel selection ····· M0
- Offset setting ····· M1
- Gain setting ····· M2
- Channel change command ····· M3
- Offset/gain setting value write command to the module ····· M4
- Mode switching····· M5
- Channel designation storage device····· D0
- Dedicated instruction (G.OFFGAN) setting storage device····· D1

(a) When switching the mode using the dedicated instruction (G.OFFGAN)
The following program switches to the offset/gain setting mode with the dedicated instruction (G.OFFGAN), changes the channel where offset/gain setting will be made, writes the offset/gain values to the A/D converter module, and then switches to the normal mode.



∗ The program in the dotted area is a common program.

(b) When switching the mode using the setting of the mode switching setting (buffer memory addresses 158, 159: Un\G158, Un\G159) and operation condition setting request (Y9)



(c) When switching the mode by making intelligent function module switch setting

Only the common program is necessary.

5 UTILITY PACKAGE (GX Configurator-AD)

5.1 Utility Package Functions

Table 5.1 shows an overview of the utility package functions.

Table 5.1 Utility package (GX Configurator-AD) function list

Item	Description	Reference section
Initial Setting ＊1	(1) Sets the following items that require initial setting. • CH A/D conversion enable/disable setting • CH Sampling process/averaging process setting • CH Time/number of times specifying • CH Average time/average number of times setting (2) The data for which initial setting has been completed is registered in the parameters for the PLC CPU, and automatically written to the A/D converter module when the PLC CPU changes to the RUN status.	Section 5.4
Automatic Refresh Settings ＊1	(1) Sets automatic refresh for the A/D converter module buffer memory. (2) The buffer memory that was set for automatic refresh is automatically read and written to the specified device when the END command for the PLC CPU is executed.	Section 5.5
Monitor/test	(1) Monitor/test The buffer memory and I/O signals for the A/D converter modules are monitored and tested. (2) Operating condition setting Changes the A/D operating status during operation. (3) Offset/gain setting When setting the offset/gain to a value selected by the user (when the analog output range setting is user range setting), the offset and gain can be easily set while viewing the screen. (4) Pass data The pass data (pass data classification setting, industrial shipment settings offset/gain values, user range settings offset/gain values) can be monitored and set.	Section 5.6

POINT

＊1 If initial setting and automatic refresh setting are performed, the intelligent function module parameters require a maximum of 76 bytes per module.

5.2 Installing and Uninstalling the Utility Package

See "Method of installing the MELSOFT Series" attached with the utility package regarding the install and uninstall operation for the utility package.

5.2.1 User precautions

The following provides the precautions on using the GX Configurator-AD:

(1) Important safety information

Since GX Configurator-AD is add-in software for GX Developer, read "Safety Precautions" and the basic operating procedures in GX Developer's operating manual.

(2) About installation

The GX Configurator-AD is an add-in package for GX Developer Version 4 or later products. Therefore, install GX Configurator-AD in a personal computer in which GX Developer Version 4 or a later product has been installed.

(3) About display-screen errors while using the intelligent function module utility

There may be cases in which the screen will not properly display while the intelligent function module utility is being used, due to a lack of system resources. If this occurs, close the intelligent function module utility first and then GX Developer (program, comments, etc.) and other applications. Next, restart GX Developer and the intelligent function module utility.

(4) To start the intelligent function module utility

(a) In GX Developer, select "QCPU (Q mode)" for the PLC series and specify the project.
If something other than "QCPU (Q mode)" is selected for the PLC series, or if the project is not specified, the intelligent function module utility will not start.

(b) Multiple intelligent function module utilities can be started.
However, the [Open file]/[Save file] intelligent function module's parameter operations can only be performed by a single intelligent function module utility. Other intelligent function module utilities can perform the [Monitor/test] operation only.

(5) How to switch screens when two or more intelligent function module utilities are started

When two or more intelligent function module utility screens cannot be displayed side by side, use the task bar to change the intelligent function module utility screen so that it is displayed on top of other screens.

(6) About the number of parameters that can be set in GX Configurator-AD

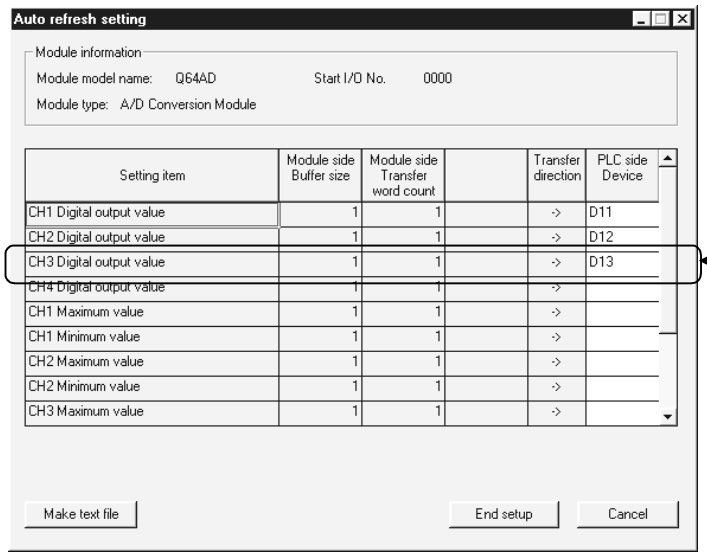
The number of parameters that can be set by the GX Configurator for an intelligent function module installed in the CPU module and in a remote I/O station of the MELSECNET/H network system is limited.

Intelligent function module installation object	Maximum number of parameter settings	
	Initial setting	Automatic refresh setting
Q00J/Q00/Q01CPU	512	256
Q02/Q02H/Q06H/Q12H/Q25HCPU	512	256
Q12PH/Q25PHCPU	512	256
MELSECNET/H remote I/O station	512	256

For example, if multiple intelligent function modules are installed in a remote I/O station, set the GX Configurator so that the number of parameter settings of all the intelligent function modules does not exceed the maximum number of parameter settings. The total number of parameter settings is calculated separately for the initial setting and for the automatic refresh setting.
The number of parameter settings that can be set for one module in the GX Configurator-AD is as shown below.

Object Module	Initial setting	Automatic refresh setting
Q64AD	2 (Fixed)	13 (Maximum number of settings)
Q68ADV/ADI	2 (Fixed)	25 (Maximum number of settings)

Example) Counting the number of parameter settings in the automatic refresh setting



The number of settings in this one line is counted as one setting.
The number of settings is not counted by columns. Add up all the setting items in this setting screen, then add them to the total for the other intelligent function modules to get a grand total.

5.2.2 Operating environment

The operating environment of the personal computer where the GX Configurator-AD is used is explained.

Item		Peripheral devices
Installation (Add-in) destination ＊1		Add-in to GX Developer Version 4 (English version) or later ＊2
Computer main unit		Personal computer on which Windows® operates.
	CPU	Refer to the following table "Used operating system and performance required for personal computer".
	Required memory	
Hard disk free space	For installation	65 MB or more
	For operation	10 MB or more
Display		800 × 600 dot or more resolution ＊3
Operating system		Microsoft® Windows® 95 Operating System (English version) Microsoft® Windows® 98 Operating System (English version) Microsoft® Windows® Millennium Edition Operating System (English version) Microsoft® Windows NT® Workstation Operating System Version 4.0 (English version) Microsoft® Windows® 2000 Professional Operating System (English version) Microsoft® Windows® XP Professional Operating System (English version) Microsoft® Windows® XP Home Edition Operating System (English version)

＊1: Install the GX Configurator-AD in GX Developer Version 4 or higher in the same language. GX Developer (English version) and GX Configurator-AD (Japanese version) cannot be used in combination, and GX Developer (Japanese version) and GX Configurator-AD (English version) cannot be used in configuration.

＊2: GX Configurator-AD cannot be used as an add-in with GX Developer Version 3 or earlier versions.

＊3: Setting fonts Size of Windows® for "Large Fonts" may cause the text to extend off screen. Therefore, choose "Small Fonts".

Used operating system and performance required for personal computer

Operating system		Performance Required for Personal Computer	
		CPU	Required memory
Windows® 95		Pentium® 133MHz or more	32MB or more
Windows® 98		Pentium® 133MHz or more	32MB or more
Windows® Me		Pentium® 150MHz or more	32MB or more
Windows NT® Workstation 4.0		Pentium® 133MHz or more	32MB or more
Windows® 2000 Professional		Pentium® 133MHz or more	64MB or more
Windows® XP Professional	"XP compatibility mode" and "Fast User Switching" are not supported.	Pentium® 300MHz or more	128MB or more
Windows® XP Home Edition		Pentium® 300MHz or more	128MB or more

5.3 Explanation of Utility Package Operation

5.3.1 How to perform common utility package operations

(1) Available control keys

Special keys that can be used during operation of the utility package and their applications are shown in the table below.

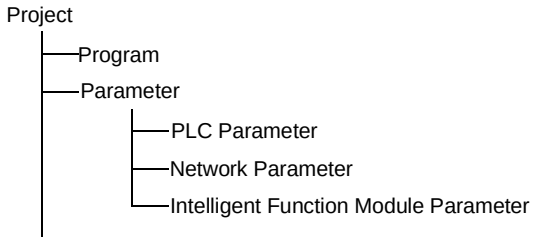
Name of key	Application
Esc	Cancels a newly entered value when entering data in a cell. Closes the window.
Tab	Moves between controls in the window.
Ctrl	Used in conjunction with the mouse when multiple cells are selected in the selection test.
Delete	Deletes the character where the cursor is positioned. When a cell is selected, clears all of the setting contents.
Back Space	Deletes the character where the cursor is positioned.
↑ ↓ ← →	Moves the cursor.
Page Up	Moves the cursor one page up.
Page Down	Moves the cursor one page down.
Enter	Confirms the value entered in the cell.

(2) Data to be created with the utility package

The data and files shown below that are created with the utility package are also processed using GX Developer operation. Figure 5.1 shows which operation processes which data or file.

<Intelligent function module parameters>

(a) This data is created with the automatic refresh setting, and stored in the intelligent function module parameter file of the project to be created using GX Developer.



(b) Steps 1) to 3) shown in Figure 5.1 are performed using the following operations.

1) Operating from GX Developer.
[Project] → [Open existing project] / [Save project] / [Save project as]
2) Operating from the utility parameter setting module selection screen.
[File] → [Open file] / [Save file]
3) Operating from GX Developer.
[Online] → [Read from PLC] / [Write to PLC] → "Intelligent function module parameters"
Or, operate from the utility parameter setting module selection screen.
[Online] → [Read from PLC] / [Write to PLC]

<Text file>

(a) A text file is created by performing the initial setting or automatic refresh setting, or selecting [text file creation] in the monitor/test screen. The text files can be utilized to create user documents.

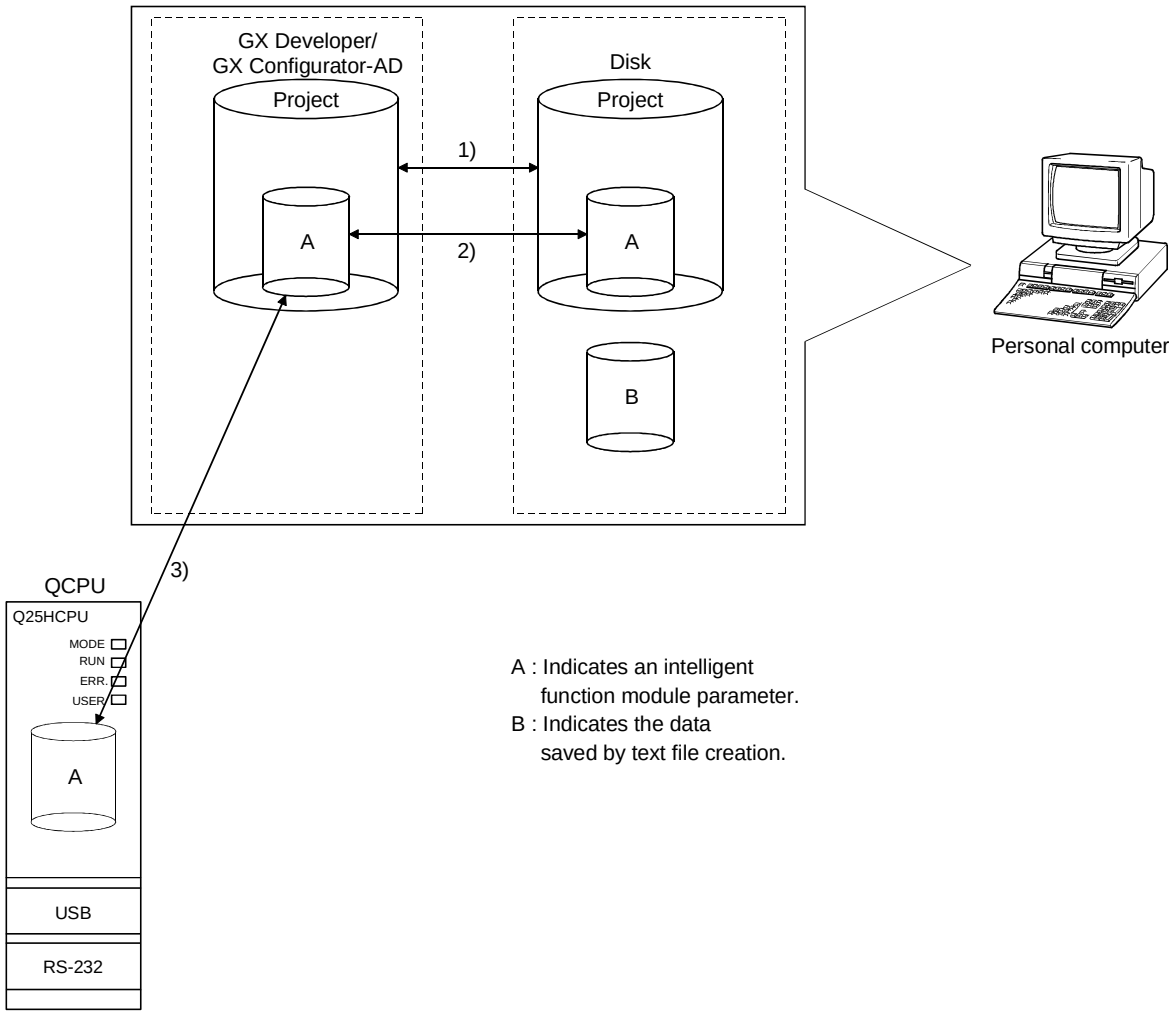
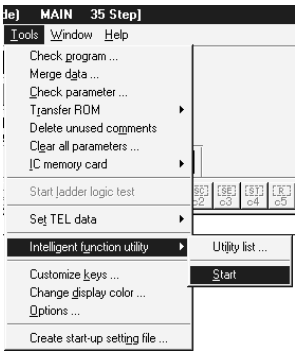


Figure 5.1 Correlation chart for data created using the utility package

5 - 7

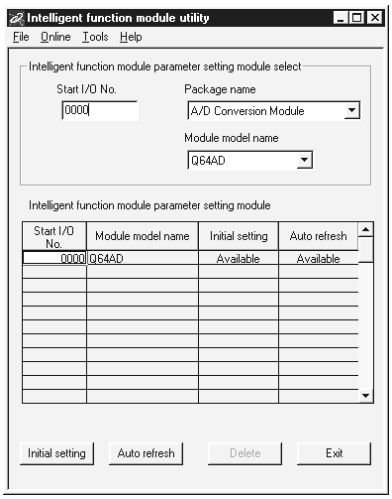
5.3.2 Operation overview

GX Developer screen



[Tools] – [Intelligent function utility] – [Start]

Intilligent function module parameter setting module select screen



See Section 5.3.3

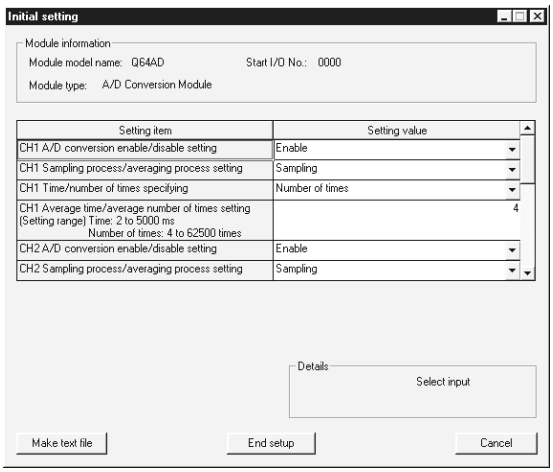
Enter "Start I/O No.", then select "Package name" and "Module model name".

1)

Initial setting

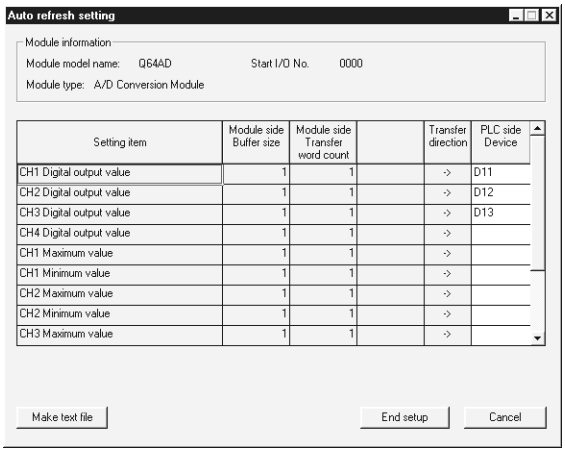
Auto refresh

Initial setting screen



See Section 5.4

Automatic refresh settings screen

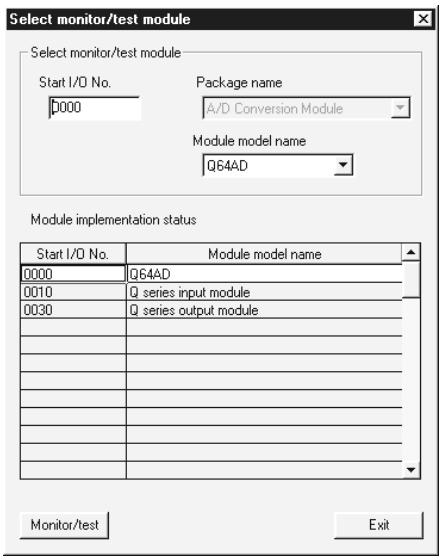


See Section 5.5

1)

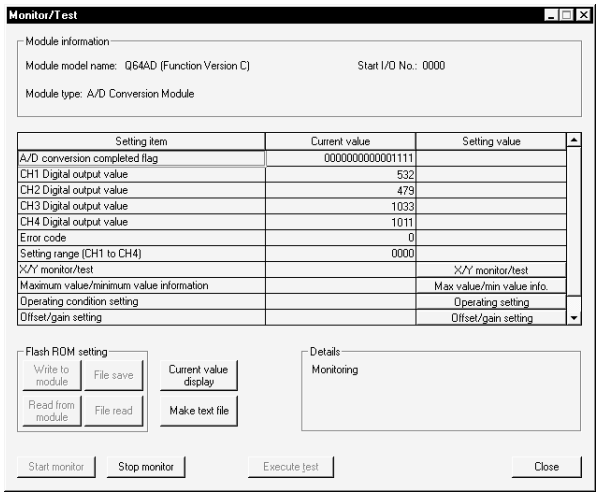
[Online] – [Monitor/test]

Select monitor/test module screen



Enter "Start I/O No.", then select "Package name" and "Module model name".

Monitor/test screen



See Section 5.6

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5.3.3 Starting the intelligent function module utility

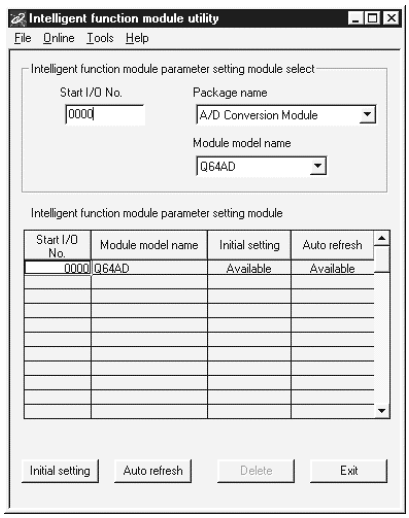
[Purpose of setting]

Start the intelligent function module utility from GX Developer, and display the module selection screen for the intelligent function module utility parameter setting. The screens for performing initial setting, automatic refresh setting and monitor/test module selection (selecting the module for which monitoring/testing is to be performed) can be started from this screen.

[Startup procedure]

[Tools] → [Intelligent function utility] → [Start]

[Setting screen]



[Explanation of items]

(1) How to start each screen

(a) Starting initial setting
"Start I/O No.∗" → "Package name" → "Module model name" → Initial setting

(b) Starting automatic refresh setting
"Start I/O No.∗" → "Package name" → "Module model name" → Auto refresh

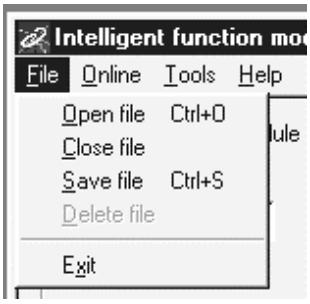
(c) Monitor/test module selection screen
Online → Monitor/test

∗ Enter the start I/O numbers in hexadecimal.

(2) Explanation of screen command buttons

Delete	Deletes the initial setting and automatic refresh setting for the selected module.
Exit	Ends the Intelligent function module utility.

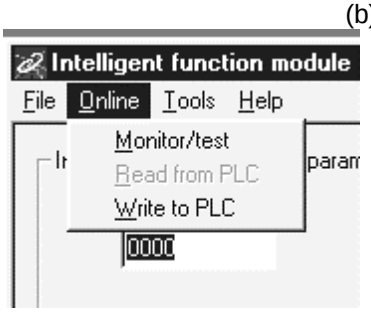
(3) Menu bar



(a) File items

With file operation, the intelligent function module parameters for the project opened by GX Developer can be processed.

[Open file]	:	Reads the parameter file.
[Close file]	:	Closes the parameter file. If revisions were made, the dialog box asking whether to save the file appears.
[Save file]	:	Saves the parameter file.
[Delete file]	:	Deletes the parameter file.
[Exit]	:	Ends the intelligent function module utility.



(b) Online items

[Monitor/test]	:	Starts the monitor/test module selection screen.
[Read from PLC]	:	Reads the intelligent function module parameters from the CPU module.
[Write to PLC]	:	Writes the intelligent function module parameters to the CPU module.

POINT

(1) Saving the intelligent function module parameter files
Since files cannot be saved using the GX Developer project save operation, save the files using the module selection screen for intelligent function module parameter setting described above.

(2) Reading from and writing to PLC operations for the intelligent function module parameters using GX Developer

(a) After the intelligent function module parameters are saved in a file, they can be read from and written into the PLC.

(b) Set the target PLC CPU using GX Developer [Online] → [Transfer setup].

(c) When the A/D converter module is installed to the remote I/O station, use "Read from PLC" and "Write to PLC".

(3) Checking for the required utility
Start I/O No. is displayed in the Intelligent function module utility setting screen, but a "*" may be displayed for the model name.
This means that either the required utility is not installed or that the utility cannot be started from the GX Developer.
Check for the required utility in [Tools] - [Intelligent function utility] - [Utility list...] in GX Developer, and set it.

5.4 Initial Setting

[Purpose of setting]

The following A/D initial setting parameters are set:

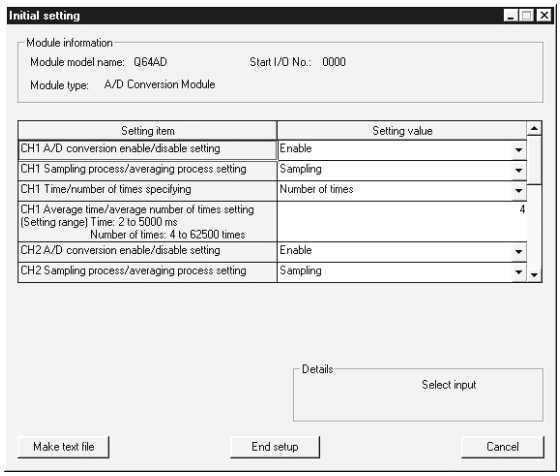
- A/D conversion enable/disable setting
- Sampling process/averaging process setting
- Time/number of times specifying
- Average time/average number of times setting

By performing these initial settings, the sequence program settings are not required.

[Startup procedure]

"Start I/O No.✻" → "Package name" → "Module model name" → Initial setting

[Setting screen]



[Explanation of items]

(1) Setting contents

Set whether A/D conversion is enabled or disabled and the A/D conversion method for each channel.

(2) Explanation of command buttons

Make text file	Outputs the screen display in text file format.
End setup	Confirms the setting data and ends the operation.
Cancel	Cancels the setting data and ends the operation.

POINT

Initial settings are stored in the intelligent function module parameters. After the initial settings are written to the CPU module, they are validated by operating the RUN-STOP switch as follows, STOP → RUN → STOP → RUN, turning the power OFF and then ON, or resetting the CPU module.

When using a sequencer program to write the initial settings, when the CPU is switched from STOP to RUN the initial settings will be written, So ensures that programming is carried out to re-execute the initial settings.

5.5 Automatic Refresh Settings

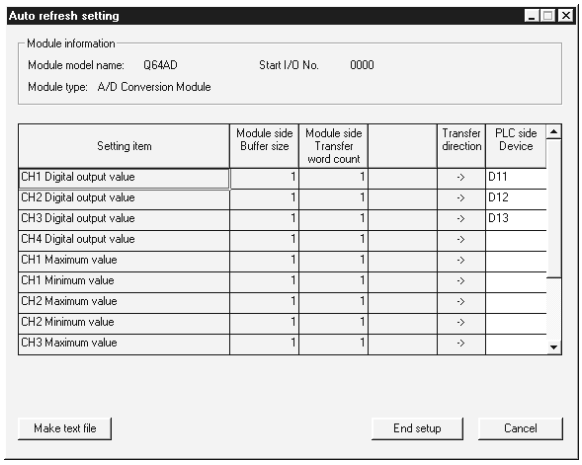
[Purpose of setting]

Sets the buffer memory for the A/D converter module to be automatically refreshed.

[Startup procedure]

"Start I/O No.✻" → "Package name" → "Module model name" → Auto refresh

[Setting screen]



[Explanation of items]

(1) Contents of the screen display

Model side Buffer size : Displays the size of the buffer memory for the setting item that can be transferred (fixed at one word).

Model side Transfer word count : Displays the number of words to transfer the CPU device from the head device (fixed at one word).

Transfer direction : "←" indicates that data is written from the device to the buffer memory.
"→" indicates that data is read from the buffer memory to the device.

PLC side Device : Enter the device at the CPU module to be automatically refreshed.
The devices that can be used are X, Y, M, L, B, T, C, ST, D, W, R, ZR. When using bit devices, K, Y, M, L or B, set a number that can be divided by 16 points (examples: X10, Y120, M16).
Also, buffer memory data is stored in 16 point blocks starting from the device number that was set. For example, if X10 is set, data will be stored from X10 to X1F.

(2) Explanation of command buttons

Make text file	A file containing the screen contents is created in text file format.
End setup	Confirms the setting data and ends the operation.
Cancel	Cancels the setting data and ends the operation.

POINT

The automatic refresh settings are stored in the intelligent function module parameters. After the automatic refresh settings are written to the CPU module, they are validated by performing STOP → RUN → STOP → RUN operations for the CPU module, turning the power OFF and then ON, or resetting the CPU module.

The automatic refresh settings cannot be changed from the sequencer program. However, it is possible to add a process similar to automatic refresh by using the FROM/TO instructions of the sequence program.

5.6 Monitor/Test

5.6.1 Monitor/test screen

[Purpose of setting]

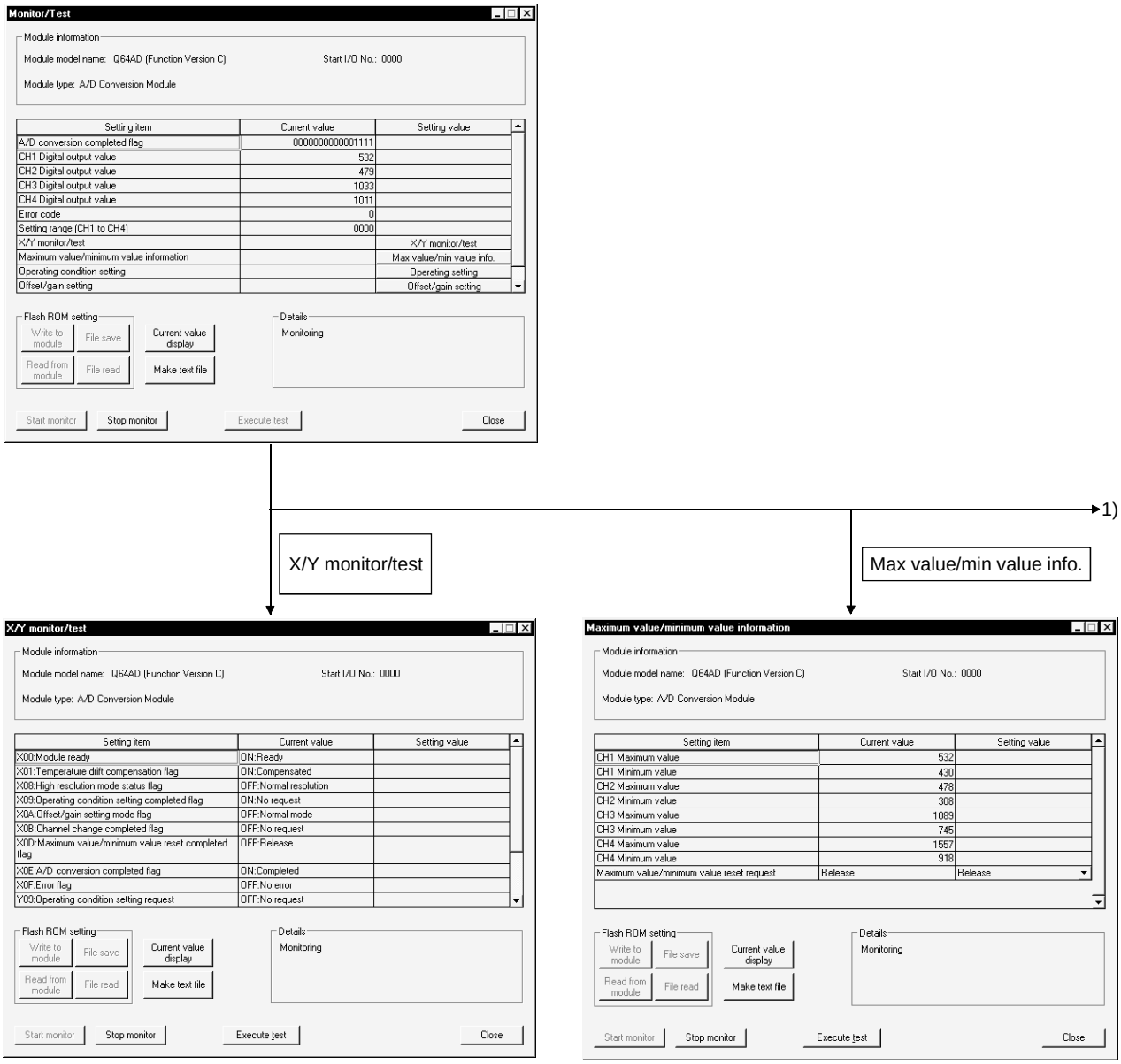
Buffer memory monitoring/testing, I/O signals monitoring/testing, operating condition setting, offset/gain settings (see Section 5.6.2, 5.6.3), pass data (see Section 5.6.4, 5.6.5) are started from this screen.

[Startup procedure]

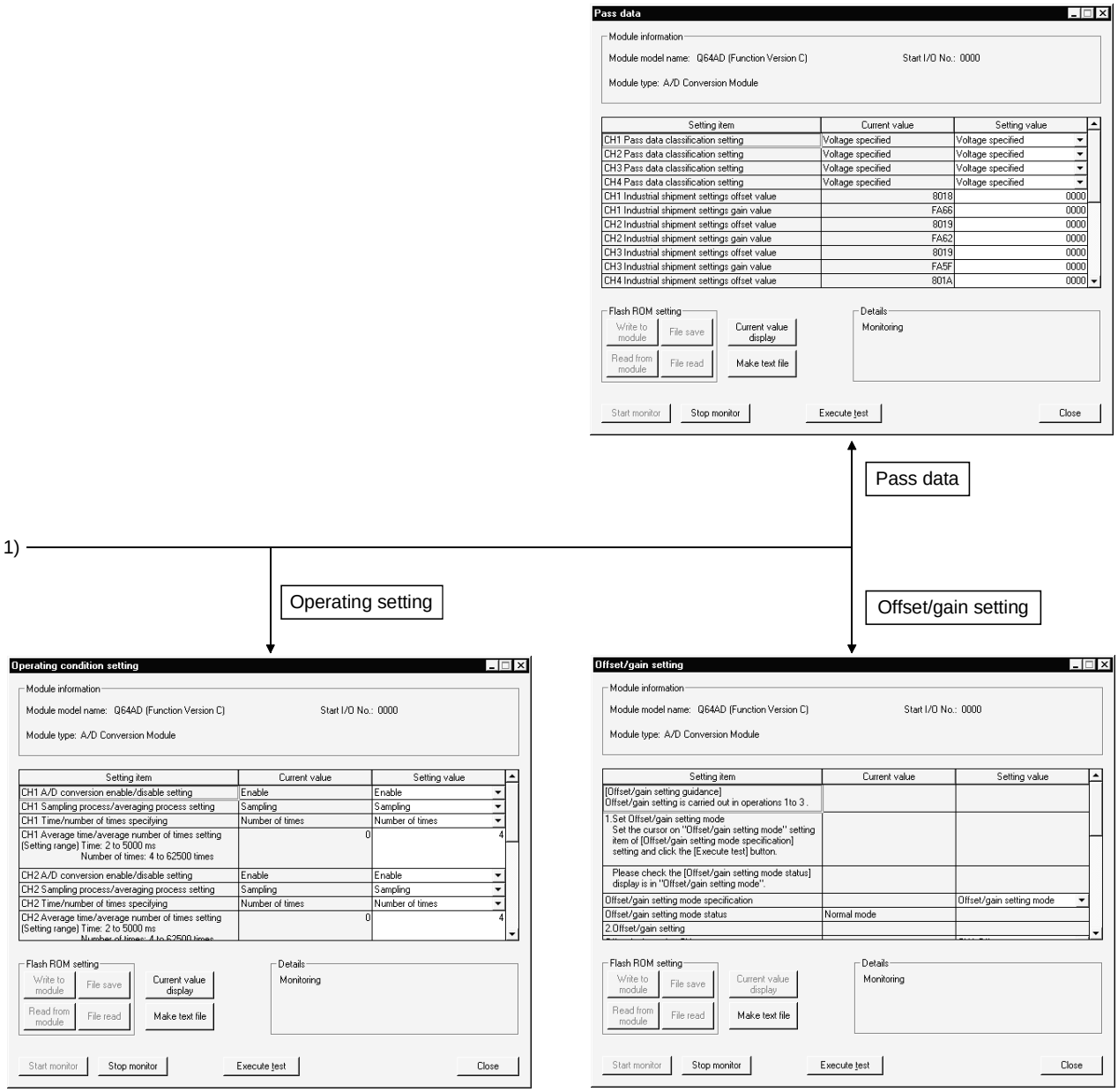
Monitor/test module selection screen → "Start I/O No.*" → "Package name" → "Module model name" → Monitor/test

* Enter the start I/O numbers in hexadecimal.
  The screen can also be started from the GX Developer Version 6 or later system monitor.
  See GX Developer's operating manual for details.

[Setting screen]



5 - 15


Pass data
Module information
Module model name: Q64AD (Function Version C)
Start I/O No.: 0000
Module type: A/D Conversion Module
Setting item
Current value
Setting value
CH1 Pass data classification setting
CH2 Pass data classification setting
CH3 Pass data classification setting
CH4 Pass data classification setting
CH1 Industrial shipment settings offset value
CH1 Industrial shipment settings gain value
CH2 Industrial shipment settings offset value
CH2 Industrial shipment settings gain value
CH3 Industrial shipment settings offset value
CH3 Industrial shipment settings gain value
CH4 Industrial shipment settings offset value
Voltage specified
8018
FA66
8019
FA62
FA5F
801A
0000
Flash ROM setting
Write to module
File save
Read from module
File read
Current value display
Make text file
Details
Monitoring
Start monitor
Stop monitor
Execute test
Close
Pass data
1)
Operating setting
Offset/gain setting
Operating condition setting
CH1 A/D conversion enable/disable setting
CH1 Sampling process/averaging process setting
CH1 Time/number of times specifying
CH1 Average time/average number of times setting
(Setting range) Time: 2 to 5000 ms
Number of times: 4 to 62500 times
CH2 A/D conversion enable/disable setting
CH2 Sampling process/averaging process setting
CH2 Time/number of times specifying
CH2 Average time/average number of times setting
Enable
Sampling
Number of times
0
4
Offset/gain setting
[Offset/gain setting guidance]
Offset/gain setting is carried out in operations 1to 3 .
1.Set Offset/gain setting mode
Set the cursor on "Offset/gain setting mode" setting item of [Offset/gain setting mode specification] setting and click the [Execute test] button.
Please check the [Offset/gain setting mode status] display is in "Offset/gain setting mode".
Offset/gain setting mode specification
Offset/gain setting mode
Offset/gain setting mode status
Normal mode
2.Offset/gain setting

[Explanation of items]

(1) Contents of screen display

Setting item : The I/O signal or buffer memory names are displayed.
Current value : The I/O signal status or current value of buffer memory are monitored.
Setting value : Select or enter the data to be written during test operation.

(2) Explanation of the command buttons

Current value display	The current value of the selected item is displayed. (This is used to check text that cannot be displayed in the current value field. However, in this utility package, all items can be displayed in the display fields).
Make text file	Creates a file consisting of the screen contents in text file format.
Start monitor / Stop monitor	Selects whether or not the current value fields are monitored.
Execute test	Performs a test of the selected item. To select more than one item, select multiple items while holding down the Ctrl key.
Close	Closes the screen currently displayed and returns to the previously displayed screen.

REMARK

The following describes an example where sampling process for the selection test operation is changed to a 10-time averaging process setting.

(1) Set averaging process in the setting value field for CH□ Sampling process/Averaging process setting.
(2) Set number of times in the setting value field for CH□ Time/number of times specifying.
(3) Click the setting value field for CH□ Average time/average number of times setting to select.
(4) After entering the average number of times, press the Enter key.
At this point, nothing has been written to the A/D converter module.
(5) Select the setting value fields that were specified in steps 1 to 4 while holding down the Ctrl key.
(6) Click Execute test to execute write operation.
Once writing has been completed, the value that was written will be displayed in the present value field.

5.6.2 Offset/gain setting operation (Function version C or later)

Perform the offset/gain setting operation in the following sequence.

(1) Switch to the offset/gain setting screen

Perform the operation in Section 5.6.1 to display the offset/gain setting screen.

(2) Switch to the offset/gain setting mode

Change the Setting value field of Offset/gain setting mode specification to "Offset/gain setting mode", and click the Execute test button to perform write.

When write is completed, the indication in the Current value field of Offset/gain setting mode status changes to "Offset/gain setting mode".

(3) Adjustment of the offset and gain values

(a) Set the analog input value for the offset value
Add the voltage or current that will determine the offset value to the channel to be set.

(b) Select the channel for which the offset value is to be adjusted
Make the selection from the offset/gain setting channel field, and then click on the Execute test button.

(c) Set the analog input value for the gain value
Add the voltage or current that will determine the gain value to the channel to be set.

(d) Select the channel for which the gain value is to be adjusted
Make the selection from the offset/gain setting channel field, and then click on the Execute test button.

(e) To set the offset/gain for more than one channel, repeat steps (a) to (d).

(4) Write the offset/gain setting values to the module

Write the offset/gain settings to the module after completing the settings for all channels using the user range setting. Note that if settings are written while offset/gain settings are incomplete, the status at that point will be written to the module.

(a) Write to the A/D converter module
Select "Write requested" from the setting value field for the offset/gain setting write request, and then click on the Execute test button.

(b) Confirm execution of write operation
Confirm that the current value field display for the offset/gain module write request changes from "Write request" to "No write request".

(c) Error handling
Confirm that the ERROR LED for the A/D converter module is off. If the ERROR LED is lit, click on Close, check the error code on the monitor screen, and then perform the offset/gain settings again.

(5) Switch to the normal mode

Change the Setting value field of Offset/gain setting mode specification to "Normal mode", and click the Execute test button to perform write.

When write is completed, the indication in the Current value field of Offset/gain setting mode status changes to "Normal mode".

5.6.3 Offset/gain setting operation (Function version B or earlier)

Perform the offset/gain setting operation in the following sequence.

(1) Switch to the offset/gain setting mode

Change switch 4 for intelligent function module switch setting to the offset/gain setting mode (see Section 4.5).

(2) Switch to the offset/gain setting screen

Display the offset/gain setting screen using the operation described in Section 5.6.1.

(3) Adjustment of the offset and gain values

(a) Set the analog input value for the offset value
Add the voltage or current that will determine the offset value to the channel to be set.

(b) Select the channel for which the offset value is to be adjusted
Make the selection from the offset/gain setting channel field, and then click on the Execute test button.

(c) Set the analog input value for the gain value
Add the voltage or current that will determine the gain value to the channel to be set.

(d) Select the channel for which the gain value is to be adjusted
Make the selection from the offset/gain setting channel field, and then click on the Execute test button.

(e) To set the offset/gain for more than one channel, repeat steps (a) to (d).

(4) Write the offset/gain setting values to the module

Write the offset/gain settings to the module after completing the settings for all channels using the user range setting. Note that if settings are written while offset/gain settings are incomplete, the status at that point will be written to the module.

(a) Write to the A/D converter module
Select "Write requested" from the setting value field for the offset/gain setting write request, and then click on the Execute test button.

(b) Confirm execution of write operation
Confirm that the current value field display for the offset/gain module write request changes from "Write request" to "No write request".

(c) Error handling

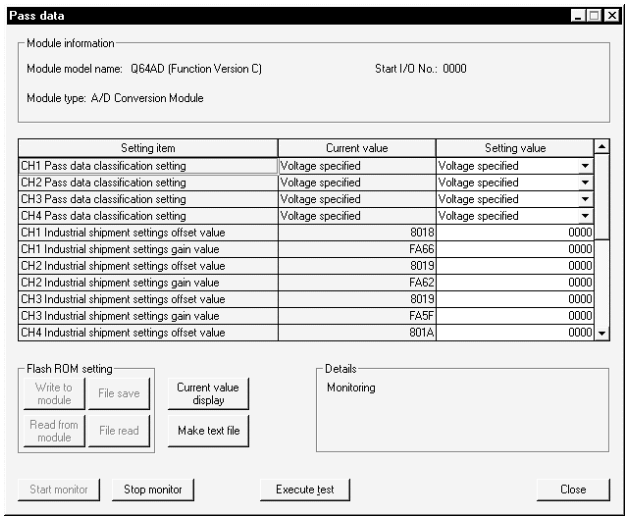
Confirm that the ERROR LED for the A/D converter module is off. If the ERROR LED is lit, click on Close , check the error code on the monitor screen, and then perform the offset/gain settings again.

5.6.4 Pass data (Q64AD)

Perform operation in the following sequence to save/restore the user range.

(1) Switch to the pass data screen

Perform the operation in Section 5.6.1 to display the Pass data screen.



(2) User range saving

(a) Set "Voltage specified" or "Current specified" in the Setting value field of Pass data classification setting, and click the Execute test button.

When the setting is completed, the set data is displayed in the Current value field of CH□ Pass data classification setting.

(b) Change the Setting value field of Pass data read request to "Request", and click the Execute test button.

When read is completed, the values are displayed in the Current value fields of CH□ Industrial shipment settings offset/gain values/CH□ User range settings offset/gain values.

(c) Compare the values with those in the range reference table, and record them if they are correct.

Refer to Section 7.4 for the range reference table.

(3) User range restoration

(a) Set "Voltage specified" or "Current specified" in the Setting value field of Pass data classification setting, and click the Execute test button.

When the setting is completed, the set data is displayed in the Current value field of CH□ Pass data classification setting.

(b) Set the recorded values in the Setting value fields of CH□ Industrial shipment settings offset/gain values/user range settings offset/gain values.

(c) Select all the Setting value fields of CH□ Industrial shipment settings offset/gain values/user range settings offset/gain values, and click the Execute test button.

When write is completed, the set values are displayed in the Current value fields of CH□ Industrial shipment settings offset/gain values/CH□ User range settings offset/gain values.

(d) Change the Setting value field of Pass data write request to "Request", and click the Execute test button.

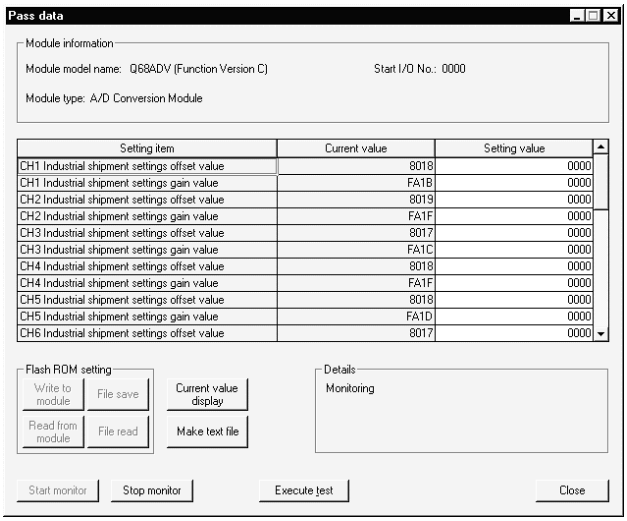
Make sure that the indication in the Current value field of Pass data write request changes from "Request" to "OFF" on completion of write.

5.6.5 Pass data (Q68ADV/Q68ADI)

Perform operation in the following sequence to save/restore the user range.

(1) Switch to the pass data screen

Perform the operation in Section 5.6.1 to display the pass data screen.



(2) User range saving

(a) Change the Setting value field of pass data read request to "Request", and click the Execute test button.

When read is completed, the values are displayed in the Current value fields of CH□ industrial shipment settings offset/gain values/CH□ user range settings offset/gain values.

(b) Compare the values with those in the range reference table, and record them if they are correct.
Refer to Section 7.4 for the range reference table.

(3) User range restoration

(a) Set the recorded values in the Setting value fields of CH□ industrial shipment settings offset/gain values/user range settings offset/gain values.

(b) Select all the Setting value fields of CH□ industrial shipment settings offset/gain values/user range settings offset/gain values, and click the Execute test button.

When write is completed, the set values are displayed in the Current value fields of CH□ industrial shipment settings offset/gain values/ CH□ user range settings offset/gain values.

(c) Change the Setting value field of pass data write request to "Request", and click the Execute test button.

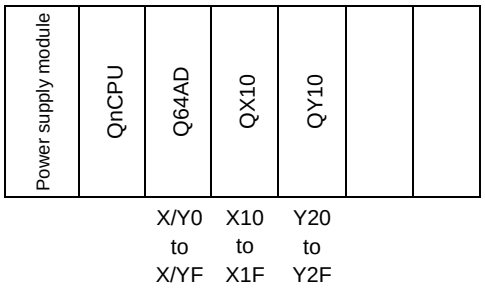
Make sure that the indication in the Current value field of pass data write request changes from "Request" to "OFF" on completion of write.

6 PROGRAMMING

Using a sample system configuration shown below, details of the A/D converter module program are explained in the following two scenarios: when the utility package is used and when the utility package is not used.

System configuration used in the program explanation

(1) System configuration



(2) Program conditions

This program reads the digital output values that have been A/D converted using CH 1 to CH3 of the Q64AD. CH1 performs sampling processing, CH2 performs averaging processing every 50 times, and CH3 performs averaging processing every 1000 ms. An error code appears in BCD format if a write error occurs.

(a) Contents of initial setting

- A/D conversion enable channel
  ·····CH1 to CH3
- Channel performing averaging processing using number of times
  ·····The average number of times set for CH2 is 50.
- Channel performing averaging processing using time
  ·····The average time set for CH3 is 1000 ms

(b) Devices used by the user

- Error reset signal ····· X10
- Input signal for digital output value read command ····· X11
- Error code display (3-digit BCD) ····· Y20 to Y2B
- CH1 digital output value ····· D11
- CH2 digital output value ····· D12
- CH3 digital output value ····· D13
- Error code ····· D14

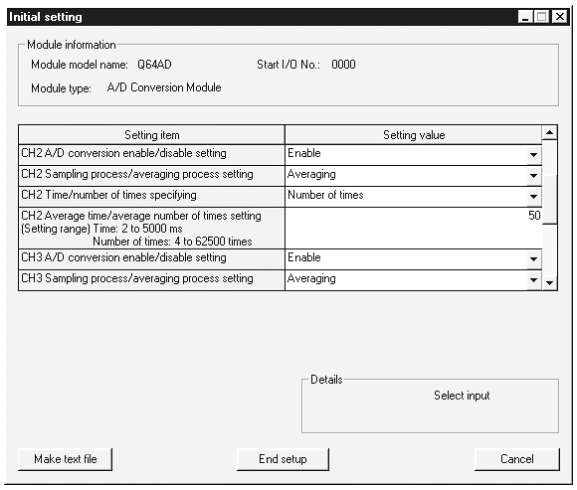
6 - 1

6.1 Programming Example Using the Utility Package

6.1.1 Operating the utility package

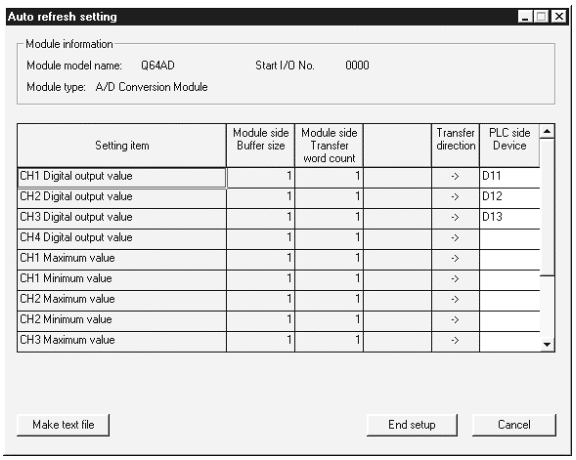
(1) Initial setting (see Section 5.4)

Set channel 1 to sampling processing, channel 2 to averaging processing for 50 times and channel 3 to averaging processing for 1000 ms.



(2) Auto refresh setting (see Section 5.5)

Set the digital output values and error codes for CH1 to 3.



(3) Writing the intelligent function module parameters (see Section 5.3.3)

Write the intelligent function module parameters to the CPU module.

This operation is performed using the parameter setting module selection screen.

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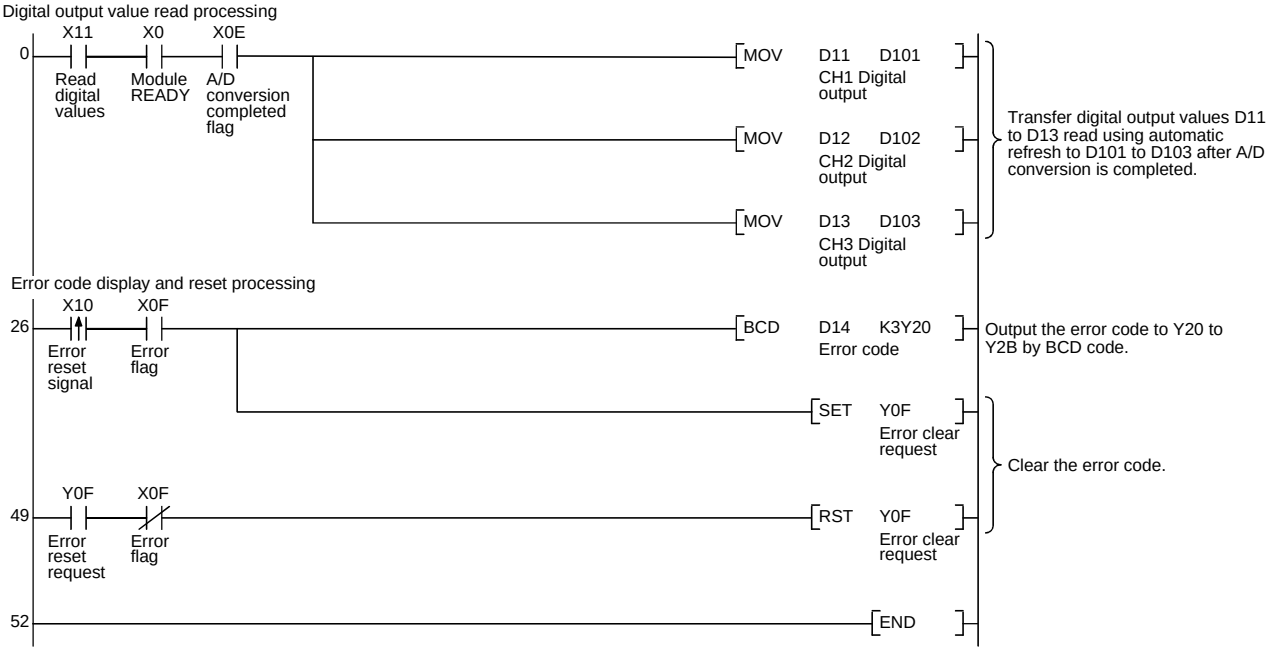
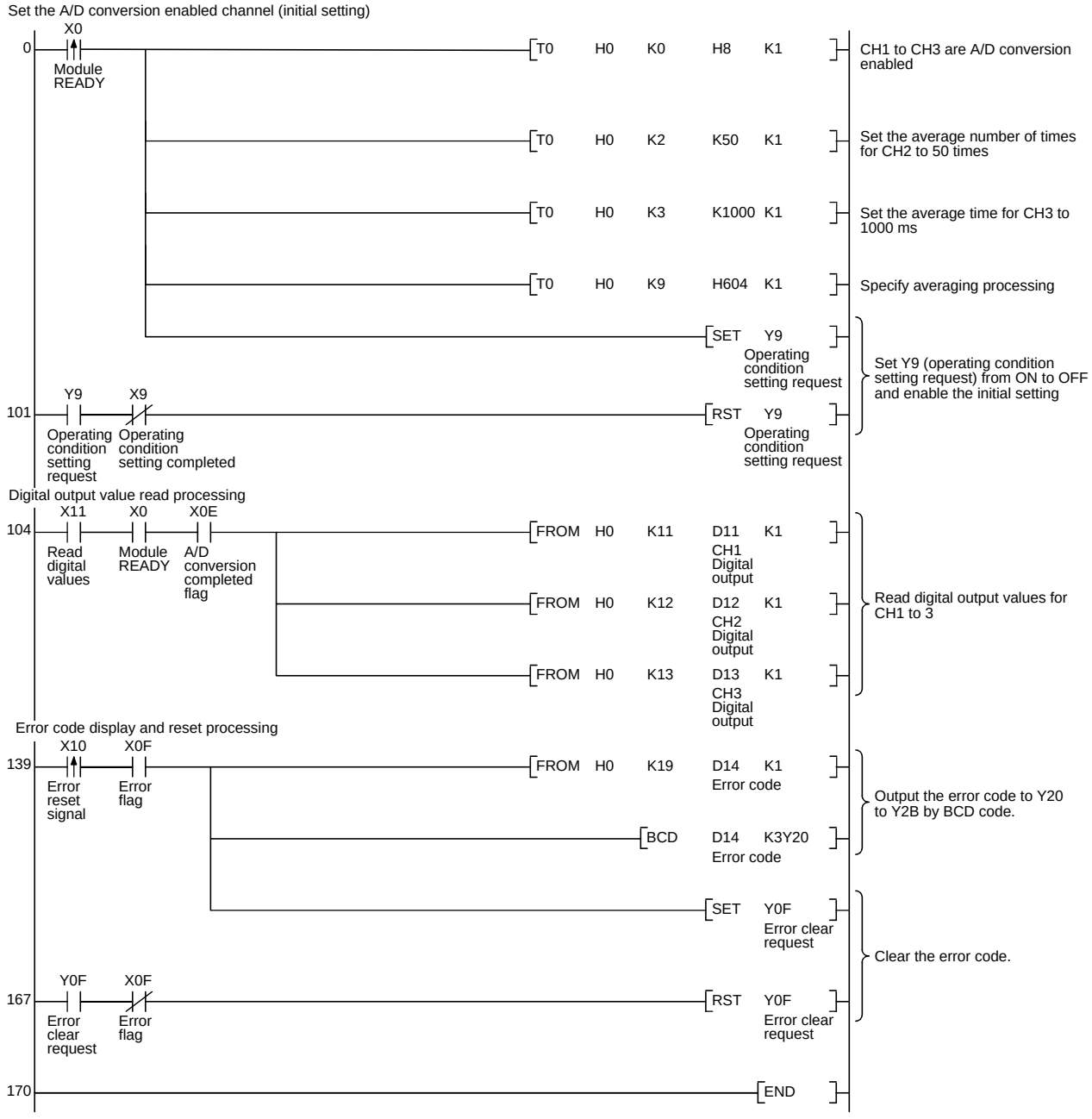
6.1.2 Programming example

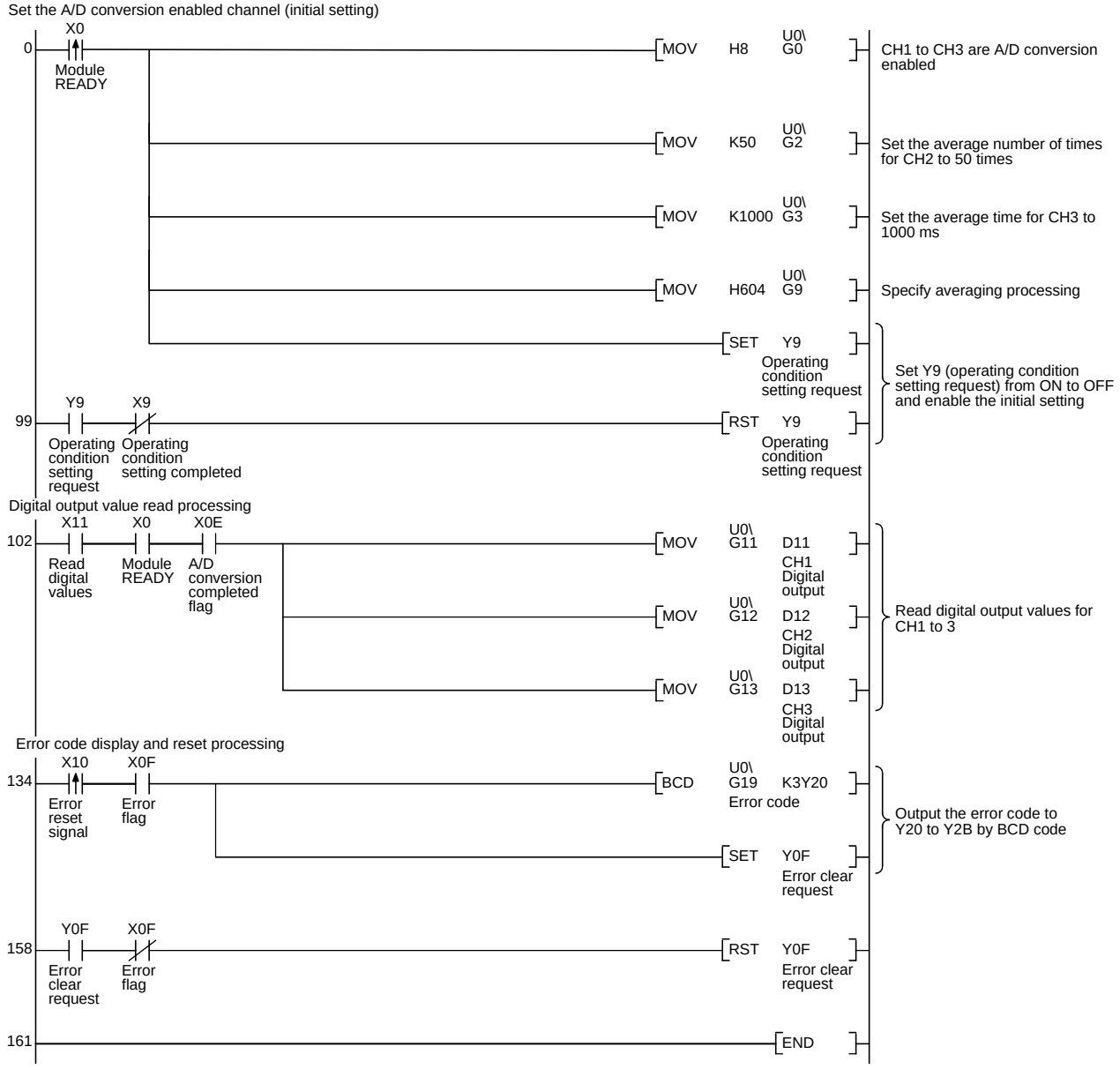


6.2 Programming Example without Using the Utility Package

(1) Programming example using the FROM/TO commands



(2) Programming example using the intelligent function module device (U□\G□)



7 ONLINE MODULE CHANGE

This chapter describes the specifications of an online module change.

(1) Perform an online module change by operating GX Developer.

(2) To ensure ease of offset/gain re-setting, there is a user range save/restoration function that is performed by executing the dedicated instruction or read/write from/to buffer memory.

POINT

- Perform an online module change after making sure that the system outside the PLC will not malfunction.
- To prevent an electric shock or like, always switch OFF the external power of the module that will be changed online.
- After the module has failed, data may not be saved properly. Referring to Section 3.4.15, therefore, prerecord the data to be saved (offset/gain values of the industrial shipment settings and user range settings in the buffer memory).

(Note)
The dedicated instruction cannot be executed during an online module change. When using the dedicated instruction to execute save/restoration, therefore, execute save/restoration in the other system.
If the other system is unavailable, execute restoration by performing write to the buffer memory.

7.1 Online Module Change Conditions

The CPU, A/D converter module, GX Developer and base unit given below are needed to perform an online module change.

(1) CPU

The Q12PHCPU or Q25PHCPU is needed. Note that it cannot be used on the remote I/O station of the MELSECNET/H.
For precautions for multiple PLC system configuration, refer to the Process CPU User's Manual (Function Explanation/Program Fundamentals).

(2) A/D converter module

The module of function version C or later is necessary.

(3) GX Developer

GX Developer of Version 7.10L or later is necessary.

(4) Base unit

1) For an online module change, use the main base unit and Q6□B extension base unit.
The module installed on the main base unit or Q6□B extension base unit can be change online.
2) The module installed on the Q5□B extension base unit cannot be changed online.
When the Q5□B is in use, the module installed on the main base unit cannot be changed online, either.

7.2 Online Module Change Operations

The following gives the operations performed for an online module change.

CPU operation ○: Executed ×: Not executed						(User operation)	(Intelligent function module operation)
X/Y refresh	FROM/TO instruction ＊1	Dedicated instruction	Device test	GX Configurator: Initial setting parameter	GX Configurator: Monitor/ test		
○	○	○	○	×	○	(1) Conversion disable Turn OFF all Y signals that were turned ON by a sequence program. (2) Dismounting of module Operate GX Developer to start an online module change. Click the [Execution] button of GX Developer to make the module dismountable. Dismount the corresponding module. (3) Mounting of new module Mount a new module. After mounting the module, click the [Execution] button of GX Developer. Operation check before control start (4) Operation check Click the [Cancel] button of GX Developer to leave the online mode. Conduct an operation test on the new module using "Device test" of GX Developer or "Monitor/test" of GX Configurator. Perform user range restoration processing by write to buffer memory at this point. Operation check completed (5) Resumption of control Operate GX Developer to resume the online module change mode, and click the [Execution] button to resume control.	Module is operating as usual. Module stops operating. • RUN LED turns off. • Conversion disabled. X/Y refresh resumes and the module starts. • RUN LED turns on. • Default operation (X0 remains OFF) When there are initial setting parameters, operation is performed according to the initial setting parameters at this point. Module operates according to test operation ＊2 X0 (Module Ready) turns ON. ↓ Start is made when X0 turns from OFF to ON. Operation is performed according to the initial setting sequence.＊2
×	×	×	×	×	×		
○	×	×	×	○	×		
○	×	×	○	×	○		
○	○	○	○	×	○		

＊1: Access to the intelligent function module device (U□\G□) is included.

＊2: In the absence of the operation marked ＊2, the operation of the intelligent function module is the operation performed prior to that.

7.3 Online Module Change Procedure

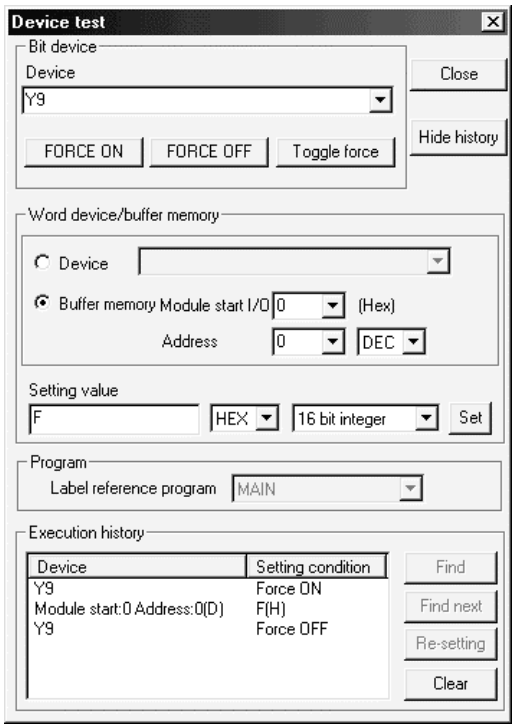
There are the following online module change procedures depending on whether the user range setting has been made or not, whether the initial setting of GX Configurator-AD has been made or not, and whether the other system exists or not.

Range setting	Initial setting	Other system	Reference section
Industrial shipment setting	GX Configurator-AD	—	Section 7.3.1
Industrial shipment setting	Sequence program	—	Section 7.3.2
User range setting	GX Configurator-AD	Present	Section 7.3.3
User range setting	GX Configurator-AD	Absent	Section 7.3.4
User range setting	Sequence program	Present	Section 7.3.5
User range setting	Sequence program	Absent	Section 7.3.6

7.3.1 When industrial shipment setting is used and initial setting was made with GX Configurator-AD

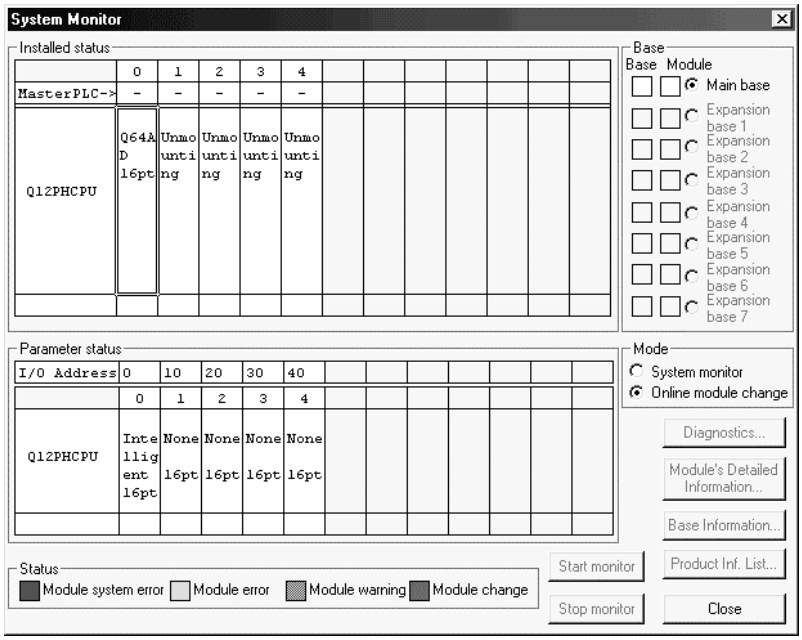
(1) Conversion disable

(a) Set the A/D conversion enable/disable setting (buffer memory address 0: Un\G0) for all channel conversion disable and turn Operation Condition Setting Request (Y9) from OFF to ON to stop conversion.

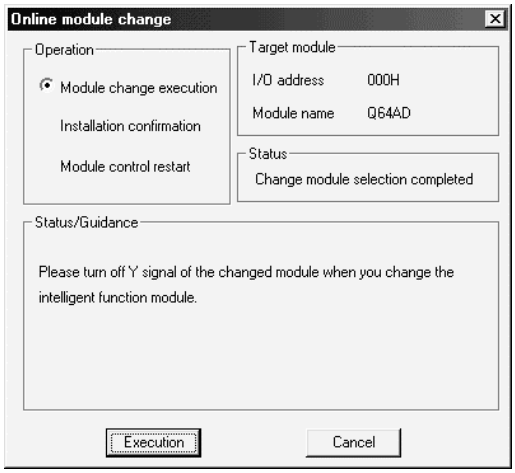


(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, click the [OK] button, dismount the module as-is, and mount a new module.

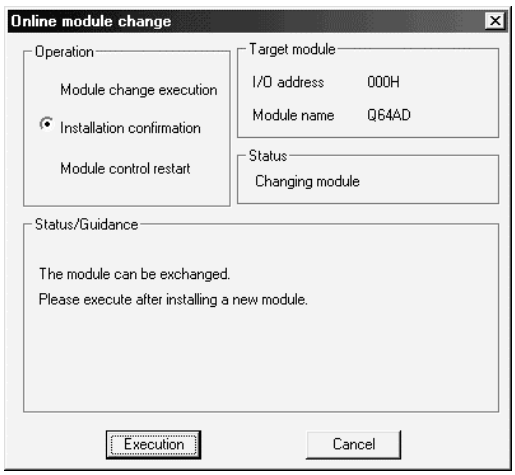
(c) After confirming that the "RUN" LED of the module has turned off, remove the terminal block and dismount the module.

POINT
Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

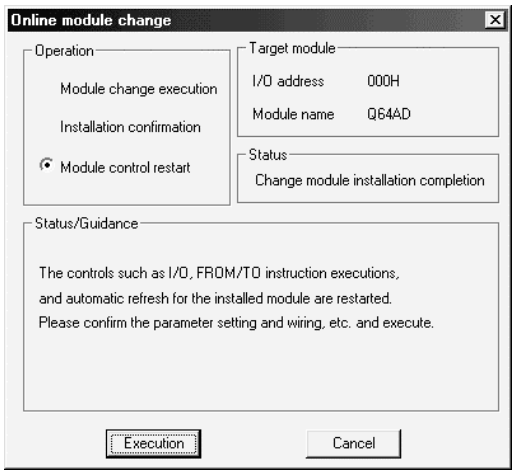
(a) Mount a new module to the same slot and install the terminal block.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready (X0) remains OFF.

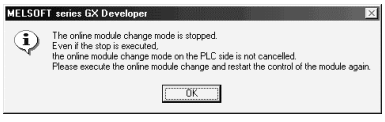


(4) Operation check

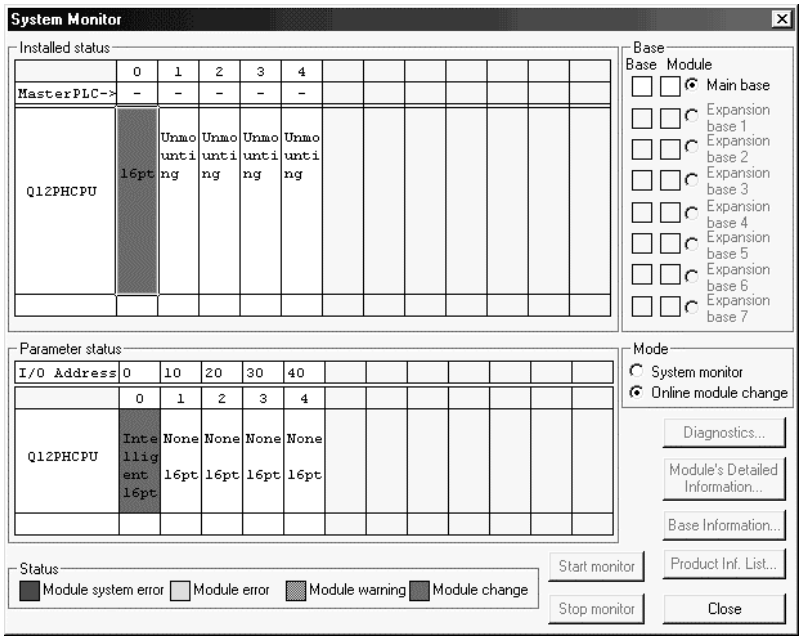
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



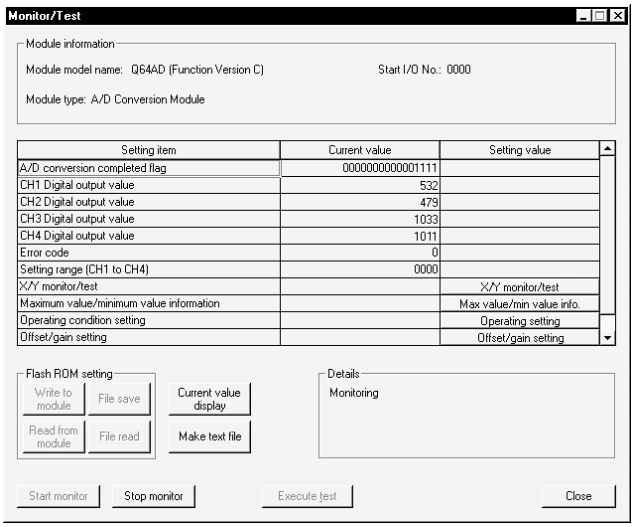
(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor screen.

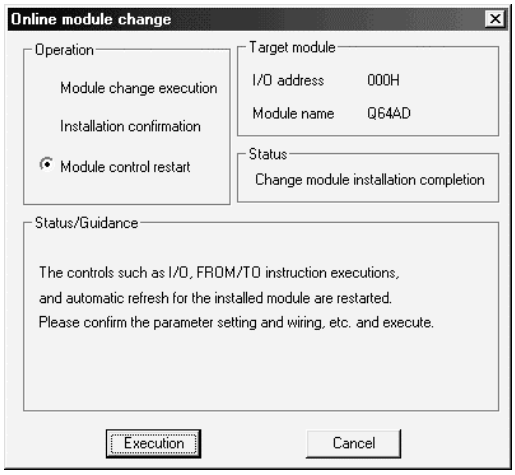


(d) Monitor the digital output values (buffer memory addresses 11 to 18: Un\G11 to 18) to check that proper conversion has been made.

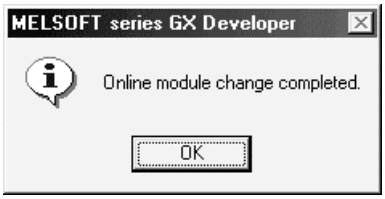


(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



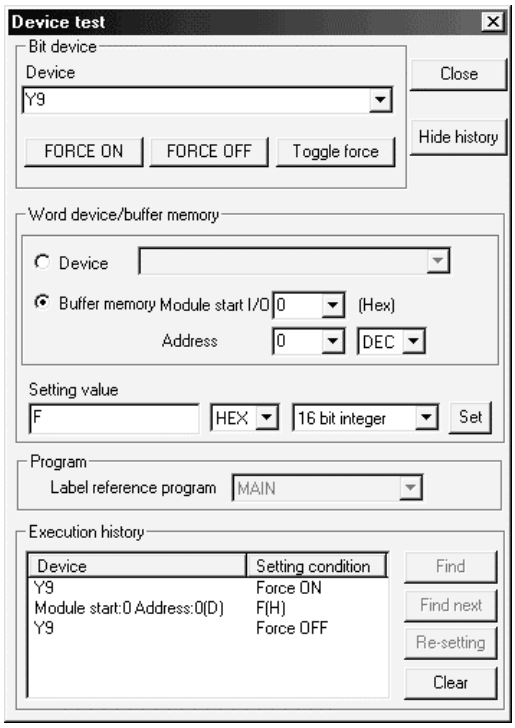
(b) The "Online module change completed" screen appears.



7.3.2 When industrial shipment setting is used and initial setting was made with sequence program

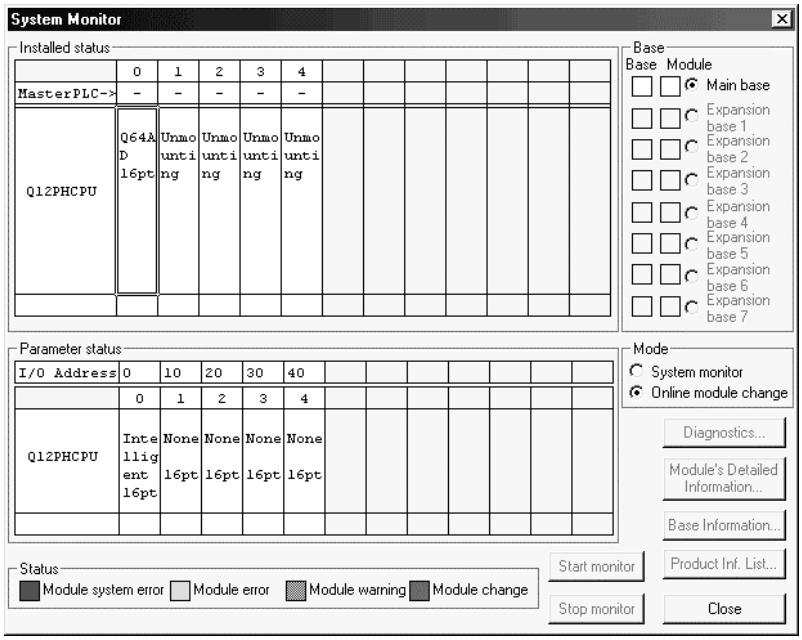
(1) Conversion disable

(a) Set the A/D conversion enable/disable setting (buffer memory address 0: Un\G0) for all channel conversion disable and turn Operation Condition Setting Request (Y9) from OFF to ON to stop conversion.

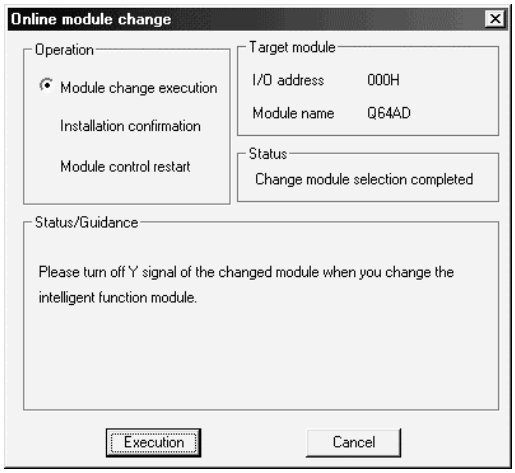


(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, click the [OK] button, dismount the module as-is, and mount a new module.

(c) After confirming that the "RUN" LED of the module has turned off, remove the terminal block and dismount the module.

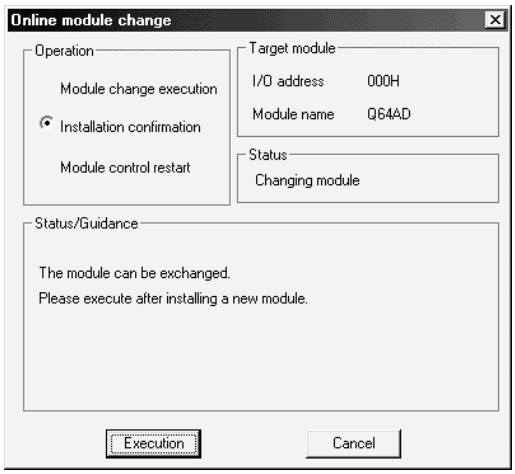
POINT

Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

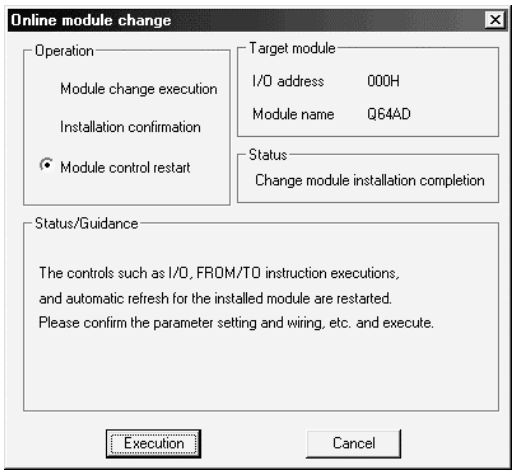
(a) Mount a new module to the same slot and install the terminal block.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready (X0) remains OFF.

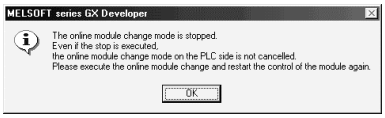


(4) Operation check

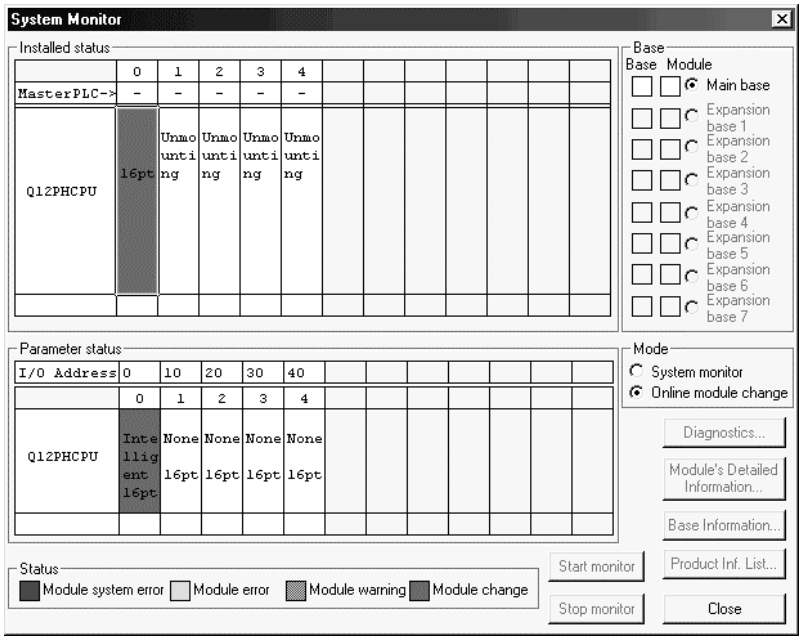
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor screen.

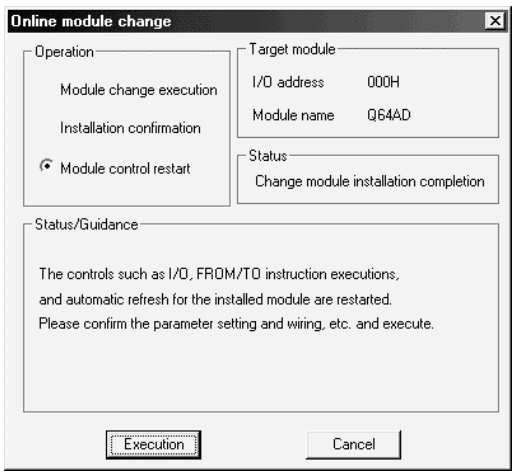


(d) Referring to (1), enable the conversion of the channels to be used, and monitor the digital output values (buffer memory addresses 11 to 18: Un\G11 to 18) to check that proper conversion has been made.

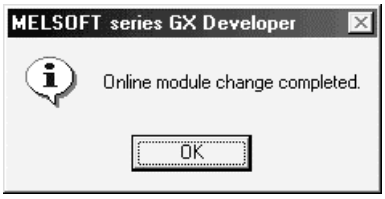
(e) Executing module control resumption resumes control according to the contents of the initial setting program. Make sure that the contents of the initial setting program are correct.

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



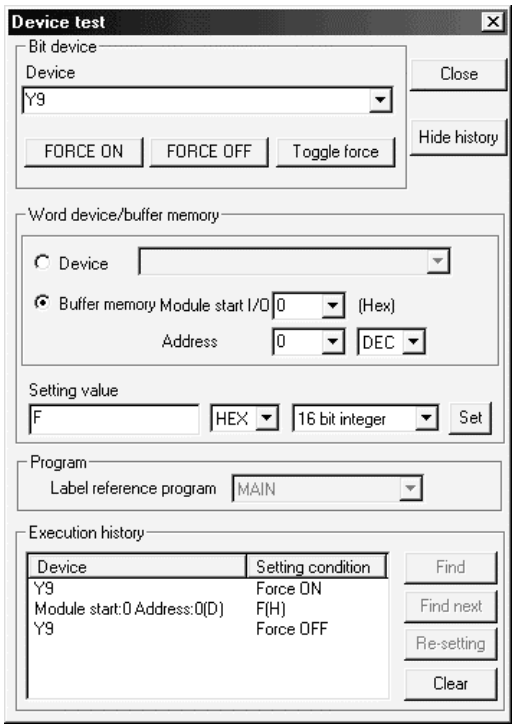
(b) The "Online module change completed" screen appears.



7.3.3 When user range setting is used and initial setting was made with GX Configurator-AD (other system is available)

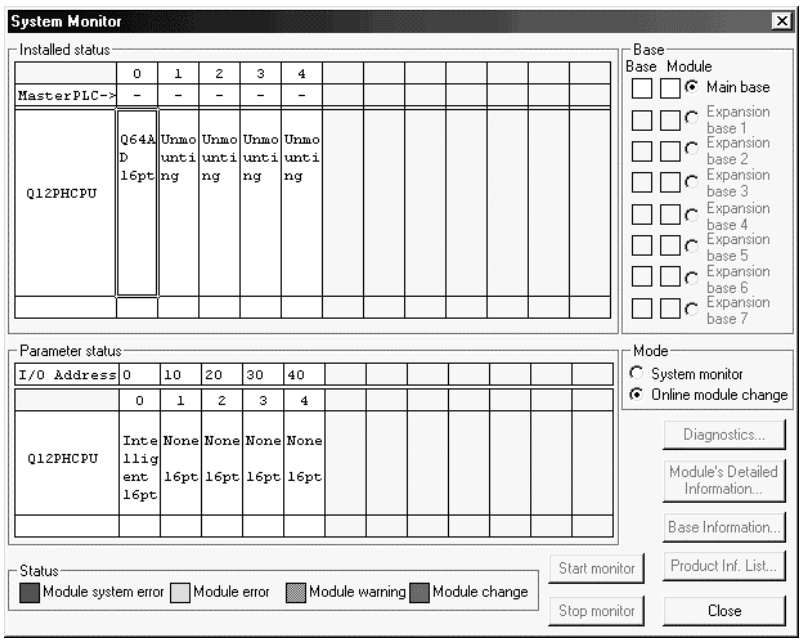
(1) Conversion disable

(a) Set the A/D conversion enable/disable setting (buffer memory address 0: Un\G0) for all channel conversion disable and turn Operation Condition Setting Request (Y9) from OFF to ON to stop conversion.

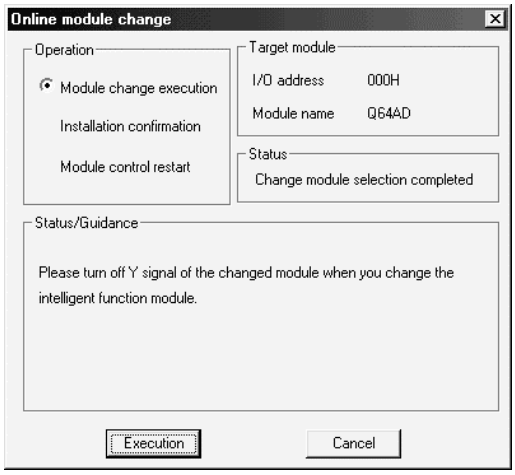


(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, the user range cannot be saved. Click the [OK] button, and perform the operation in Section 7.3.4 (2)(c) and later.

(c) After confirming that the "RUN" LED of the module has turned off, remove the terminal block and dismount the module.

POINT
Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

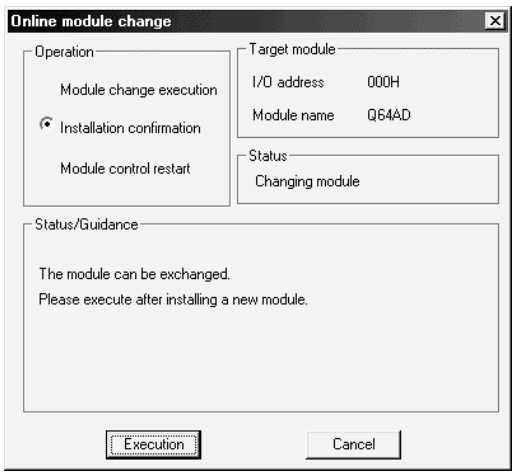
(a) Mount the dismounted module and new module to the other system.

(b) Using the G.OGLOAD instruction, save the user set values to the CPU device. Refer to Appendix 2.2 for the G.OGLOAD instruction.

(c) Using the G.OGSTOR instruction, restore the user set values to the module. Refer to Appendix 2.3 for the G.OGSTOR instruction.

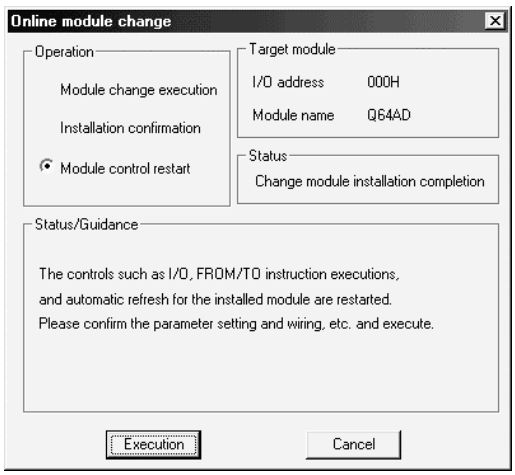
(d) Dismount the new module from the other system, mount it to the slot from where the old module was dismounted in the original system, and install the terminal block.

(e) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready (X0) remains OFF.

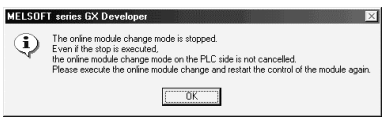


(4) Operation check

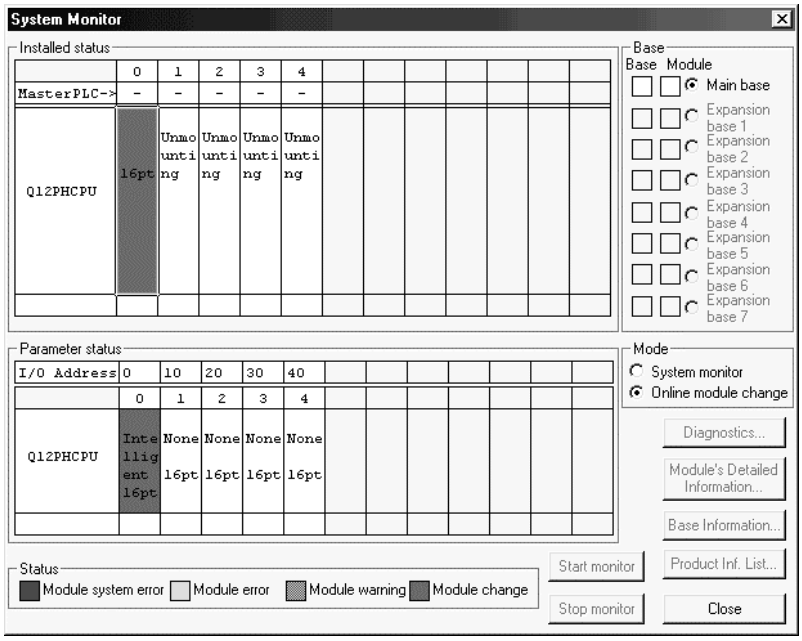
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



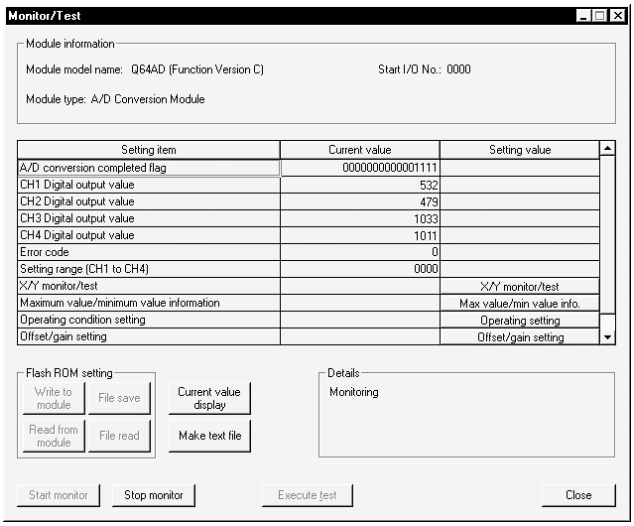
(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor screen.

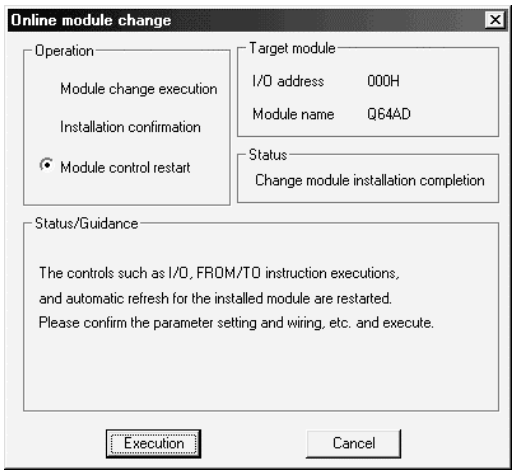


(d) Monitor the digital output values (buffer memory addresses 11 to 18: Un\G11 to 18) to check that proper conversion has been made.

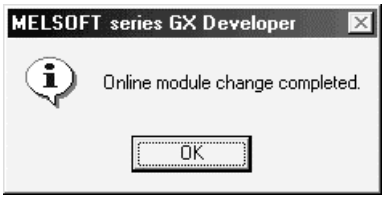


(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



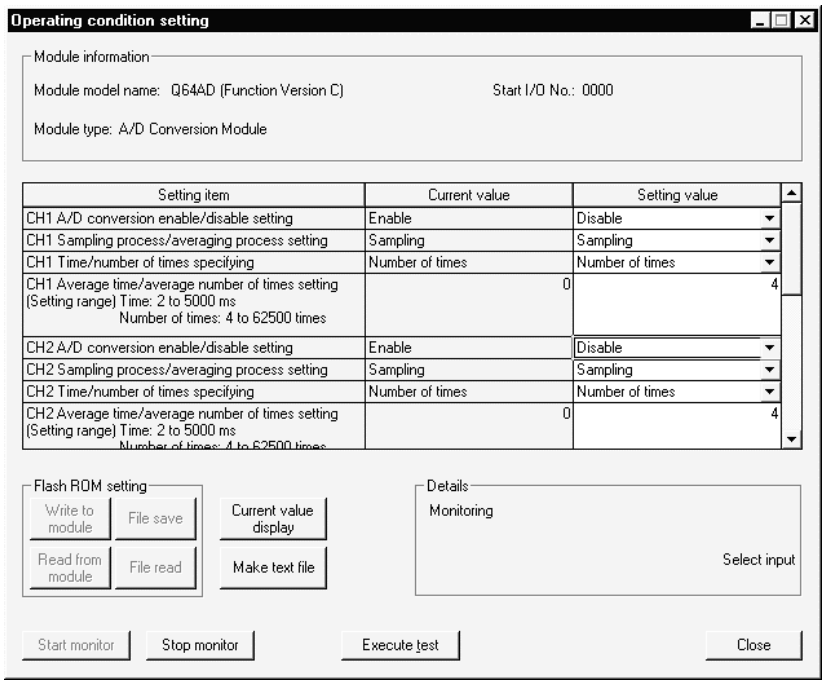
(b) The "Online module change completed" screen appears.



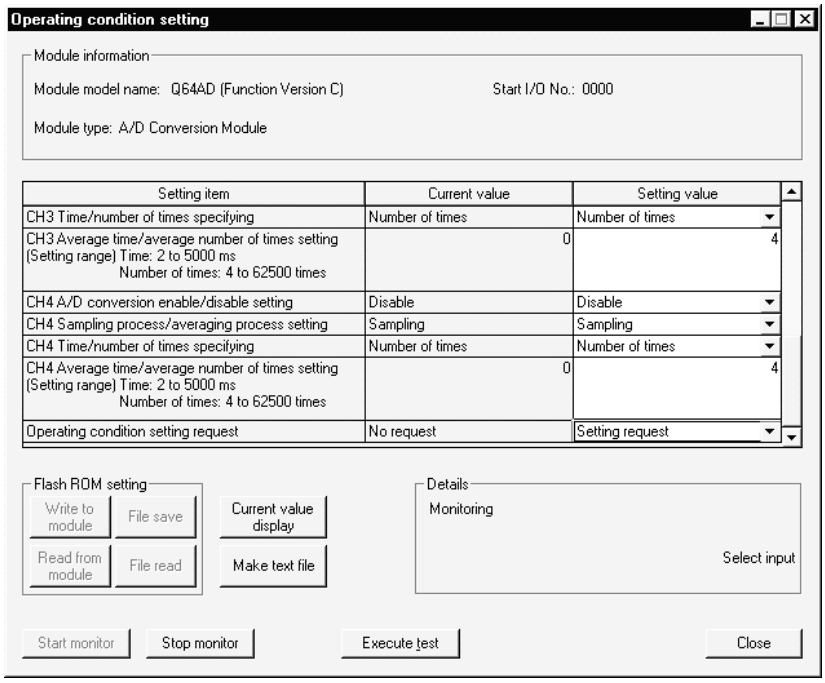
7.3.4 When user range setting is used and initial setting was made with GX Configurator-AD (other system is unavailable)

(1) Conversion disable

(a) On the Operating condition setting screen of GX Configurator-AD, set "Disable" in the Setting value field of CH□ A/D conversion enable/disable setting, and click the [Execute test] button.



(b) After making sure that the indication in the Current value field of CH□ A/D conversion enable/disable setting is "Disable", change the Setting value field of Operating condition setting request to "Setting request", and click the [Execute test] button to stop conversion.



(c) If the saved buffer memory contents are not yet prerecorded, record them in the following procedure.

1) Display the pass data screen of GX Configurator-AD.
2) Set the pass data classification setting* and make a pass data read request. (Refer to Section 5.6.4, 5.6.5.)
3) Compare the current values of the industrial shipment settings and user range settings offset/gain values with those of the range reference table. Refer to Section 7.4 for the range reference table.
4) If the values are proper, record the offset/gain values of the pass data classification setting, industrial shipment settings and user range settings.

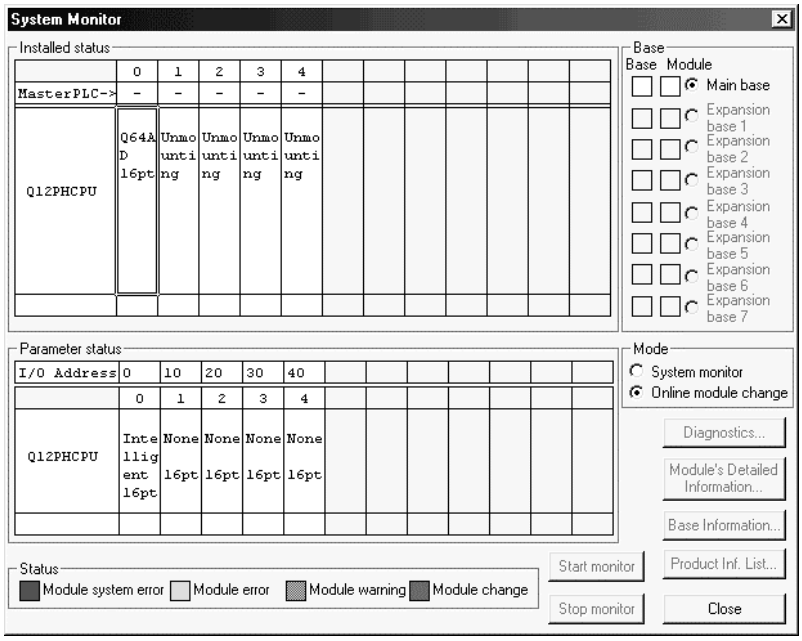
*: The Q68ADV/Q68ADI does not require the setting and recording of the pass data classification setting.

POINT

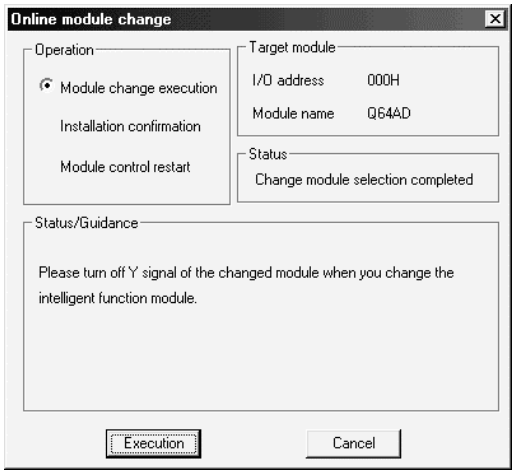
If the buffer memory values compared with the reference table are not proper, save and restoration of the user range cannot be executed.
Before executing module control resumption, make offset/gain setting in the GX Configurator-AD. (see Section 5.6.2)
Note that if module control is resumed without offset/gain setting being made, operation will be performed with the default values.

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, the user range cannot be saved.
Click the [OK] button, and perform the operation in Section (2)(c) and later.

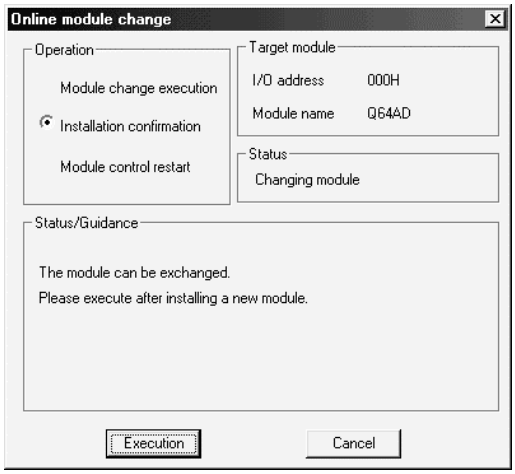
(c) After confirming that the "RUN" LED of the module has turned off, remove the terminal block and dismount the module.

POINT
Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

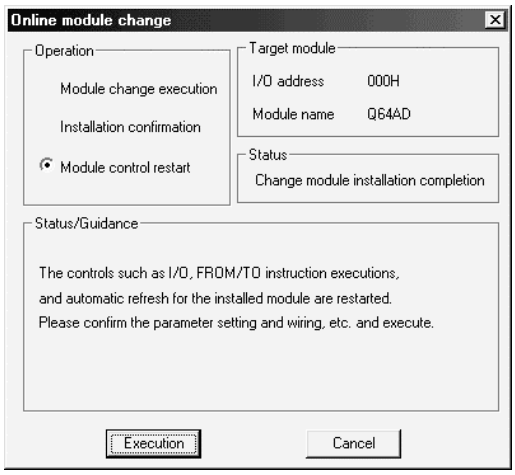
(a) Mount a new module to the same slot and install the terminal block.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready (X0) remains OFF.

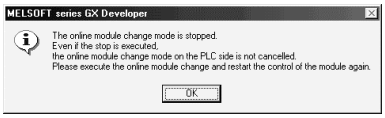


(4) Operation check

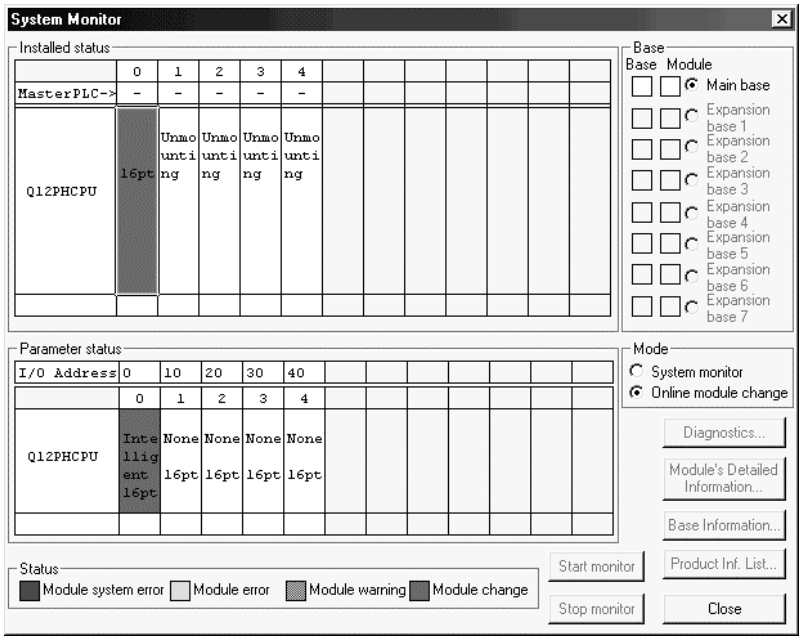
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.

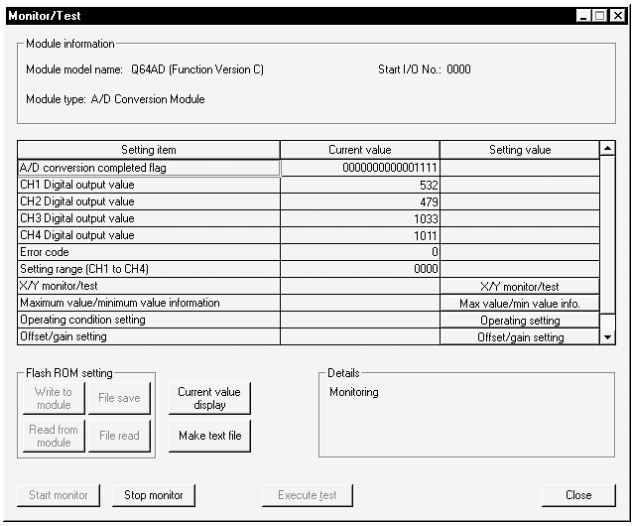


(c) Click the [Close] button to close the System monitor screen.



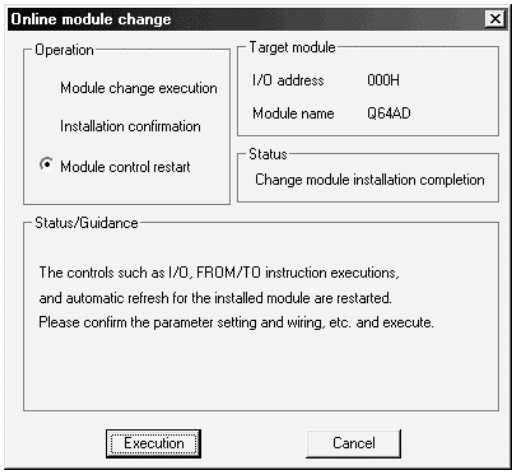
(d) On the pass data screen of GX Configurator-AD, set the prerecorded values and make a pass data write request. (Refer to Section 5.6.4, 5.6.5)

(e) Monitor the digital output values (buffer memory addresses 11 to 18: Un\G11 to 18) to check that proper conversion has been made.

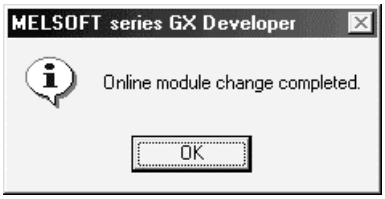


(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



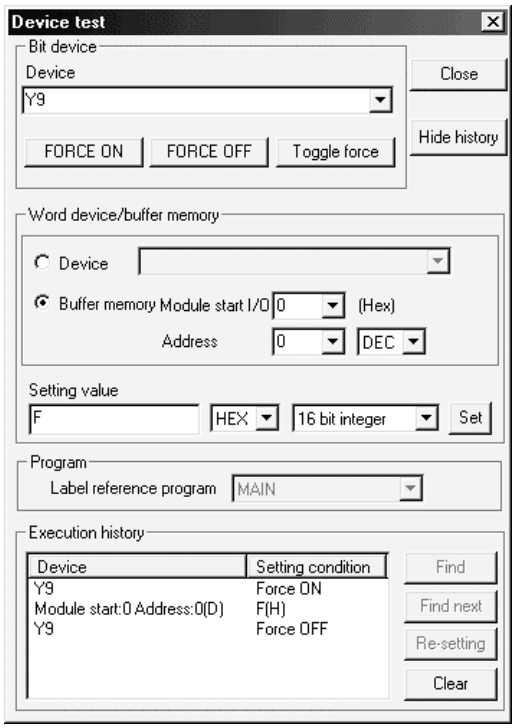
(b) The "Online module change completed" screen appears.



7.3.5 When user range setting is used and initial setting was made with sequence program (other system is available)

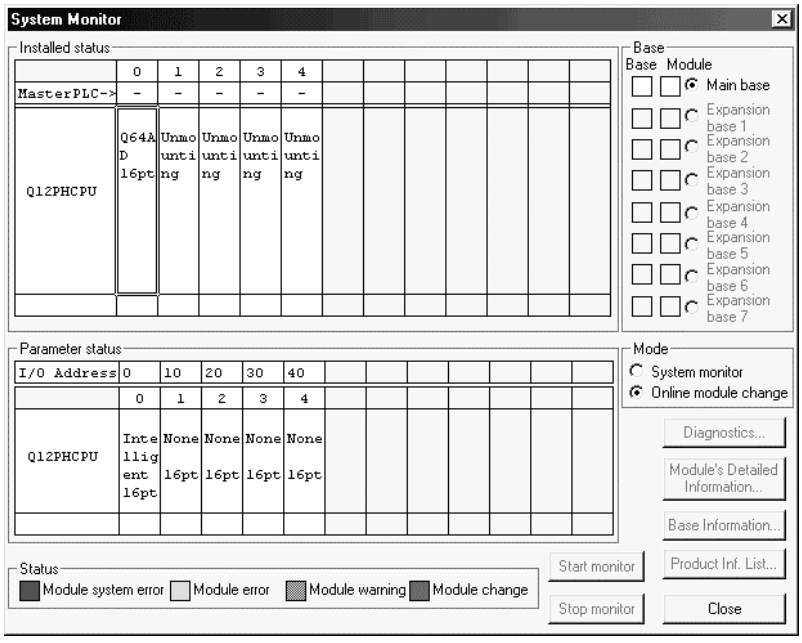
(1) Conversion disable

(a) Set the A/D conversion enable/disable setting (buffer memory address 0: Un\G0) for all channel conversion disable and turn Operation Condition Setting Request (Y9) from OFF to ON to stop conversion.

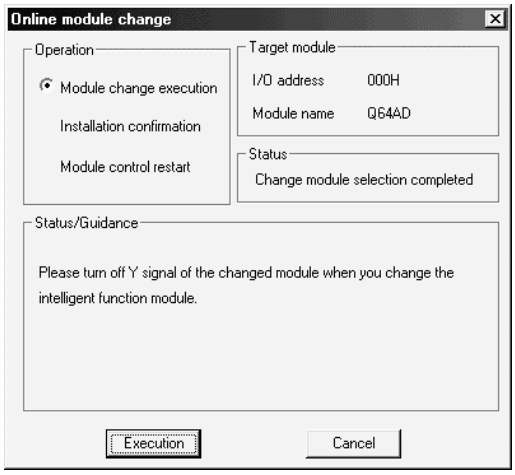


(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, the user range cannot be saved. Click the [OK] button, and perform the operation in Section 7.3.6 (2)(c) and later.

(c) After confirming that the "RUN" LED of the module has turned off, remove the terminal block and dismount the module.

POINT
Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

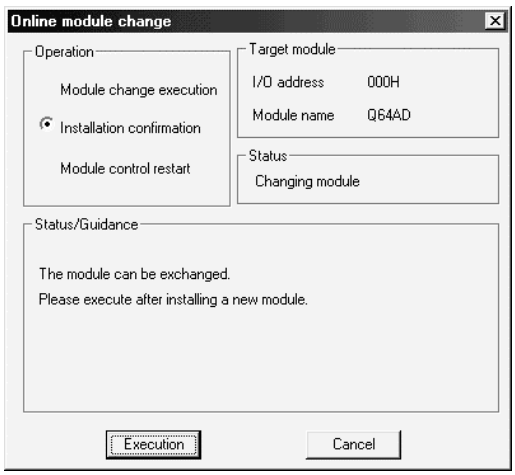
(a) Mount the dismounted module and new module to the other system.

(b) Using the G.OGLOAD instruction, save the user set values to the CPU device. Refer to Appendix 2.2 for the G.OGLOAD instruction.

(c) Using the G.OGSTOR instruction, restore the user set values to the module. Refer to Appendix 2.3 for the G.OGSTOR instruction.

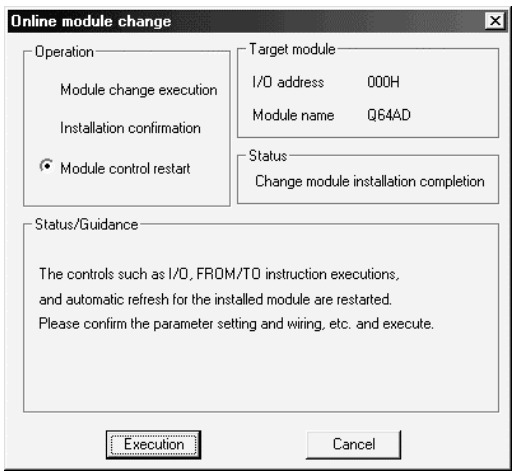
(d) Dismount the new module from the other system, mount it to the slot from where the old module was dismounted in the original system, and install the terminal block.

(e) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready (X0) remains OFF.

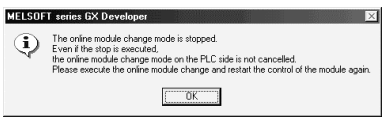


(4) Operation check

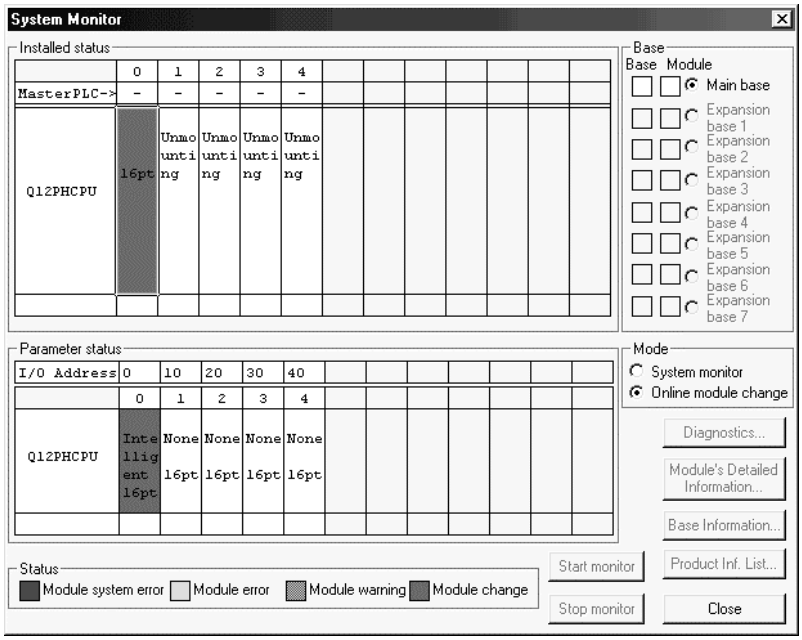
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor screen.

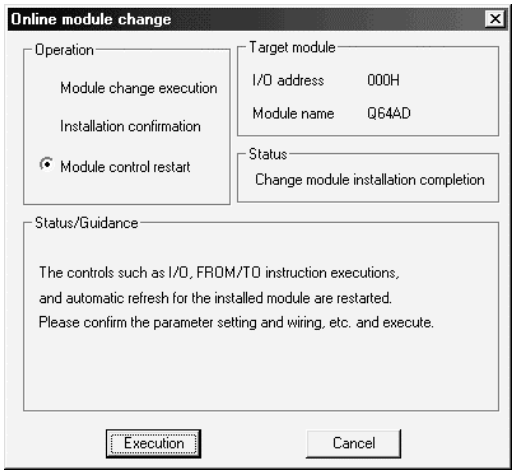


(d) Referring to (1), enable the conversion of the channels to be used, and monitor the digital output values (buffer memory addresses 11 to 18: Un\G11 to 18) to check that proper conversion has been made.

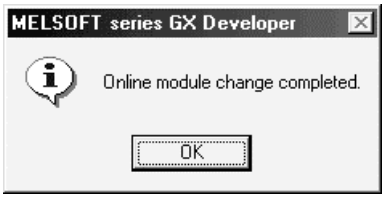
(e) Executing module control resumption resumes control according to the contents of the initial setting program. Make sure that the contents of the initial setting program are correct.

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



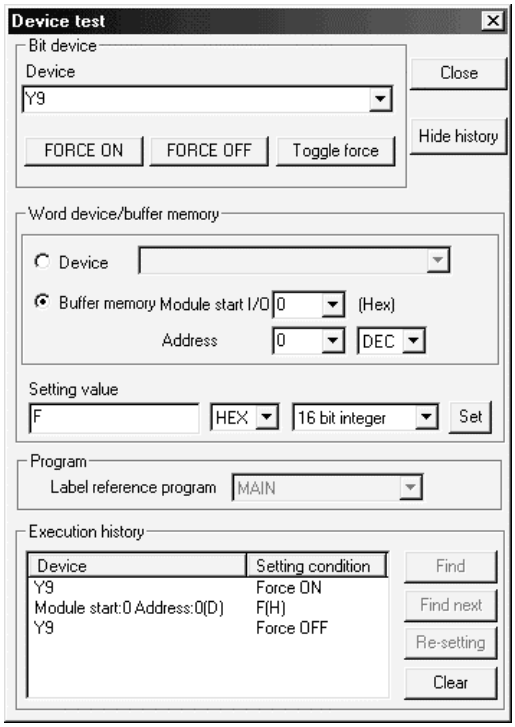
(b) The "Online module change completed" screen appears.



7.3.6 When user range setting is used and initial setting was made with sequence program (other system is unavailable)

(1) Conversion disable

(a) Set the A/D conversion enable/disable setting (buffer memory address 0: Un\G0) for all channel conversion disable and turn Operation Condition Setting Request (Y9) from OFF to ON to stop conversion.



(b) If the saved buffer memory contents are not yet prerecorded, record them in the following procedure.

1) Make the pass data classification setting * (buffer memory address 200: Un\G200).
2) Turn Operation Condition Setting Request (Y9) from OFF to ON.
3) Compare the offset/gain values of the industrial shipment settings and user range settings (buffer memory addresses 202 to 233: Un\G202 to Un\G233) with the range reference table. Refer to Section 7.4 for the range reference table.
4) If the values are proper, record the offset/gain values of the pass data classification setting *, industrial shipment settings and user range settings.

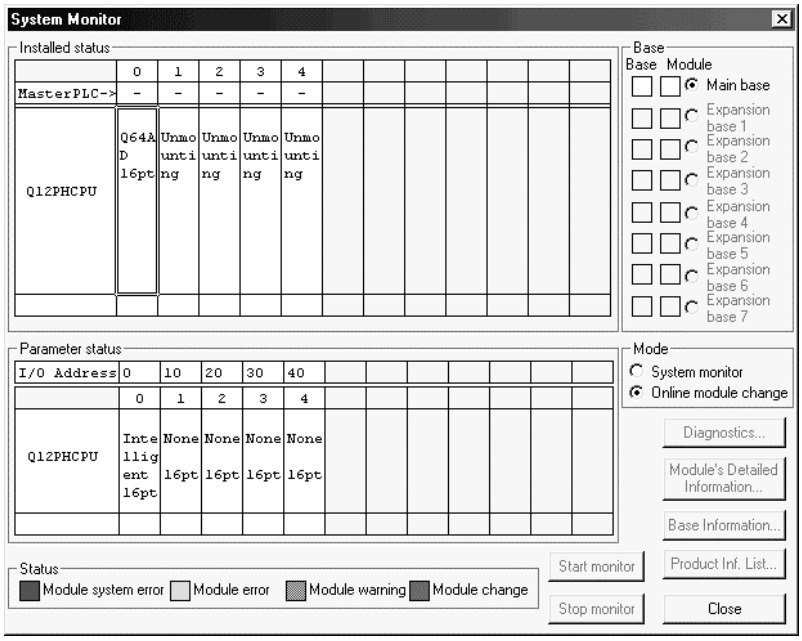
*: The Q68ADV/Q68ADI does not require the setting and recording of the pass data classification setting.

POINT

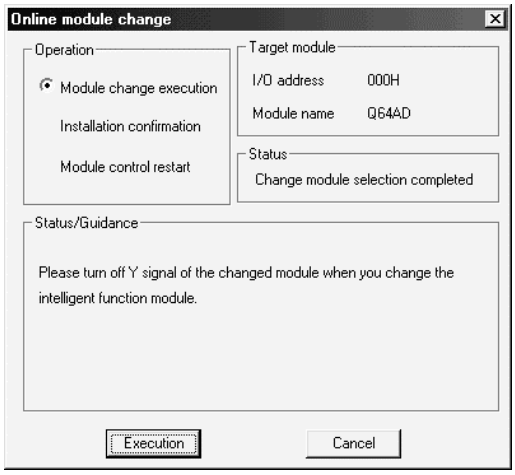
If the buffer memory values compared with the reference table are not proper, save and restoration of the user range cannot be executed.
Before executing module control resumption, follow the flowchart in Section 4.6 and make offset/gain setting in the device test of GX Developer.
Perform mode switching by making the setting of the mode switching setting (buffer memory addresses 158, 159: Un\G158, Un\G159) and turning Operation Condition Setting Request (Y9) from OFF to ON.
Note that if module control is resumed without offset/gain setting being made, operation will be performed with the default values.

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" screen.



(b) Click the "Execution" button to enable a module change.



If the following error screen appears, the user range cannot be saved.
Click the [OK] button, and perform the operation in Section (2)(c) and later.

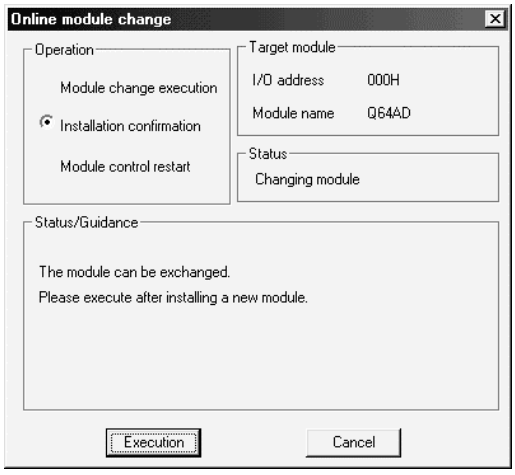
(c) After confirming that the "RUN" LED of the module has turned off, remove the terminal block and dismount the module.

POINT
Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

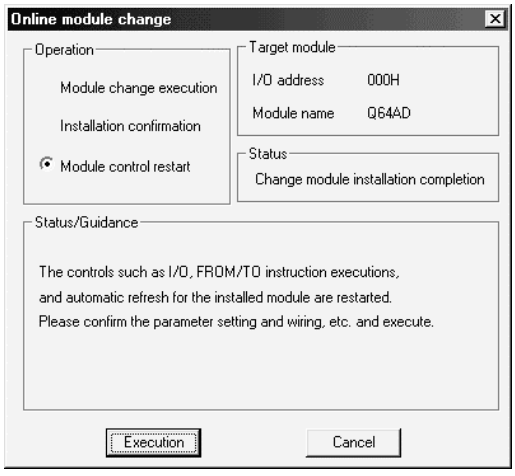
(a) Mount a new module to the same slot and install the terminal block.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module Ready (X0) remains OFF.

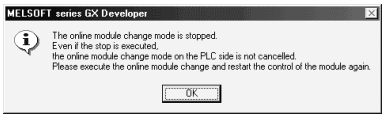


(4) Operation check

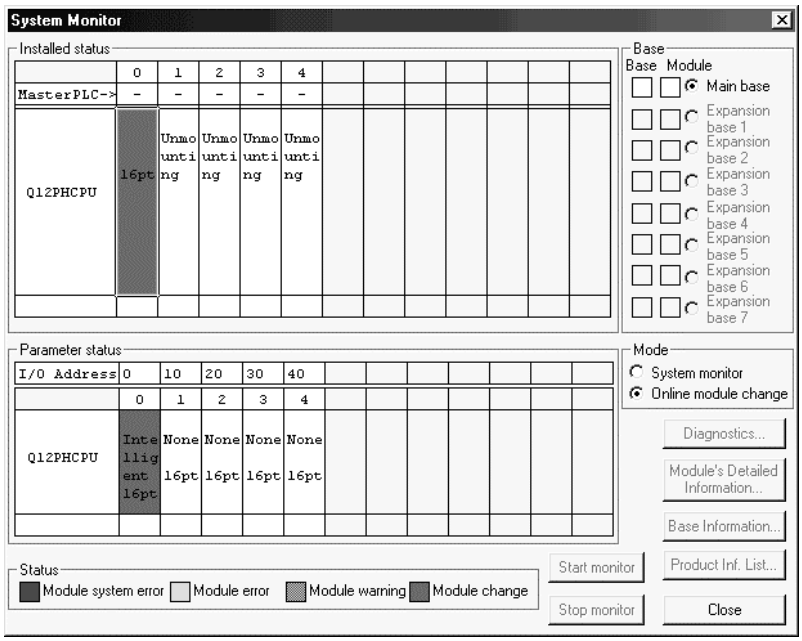
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor screen.



(d) Choose [Online] - [Debug] - [Device test] on GX Developer and set the prerecorded values to the buffer memory.

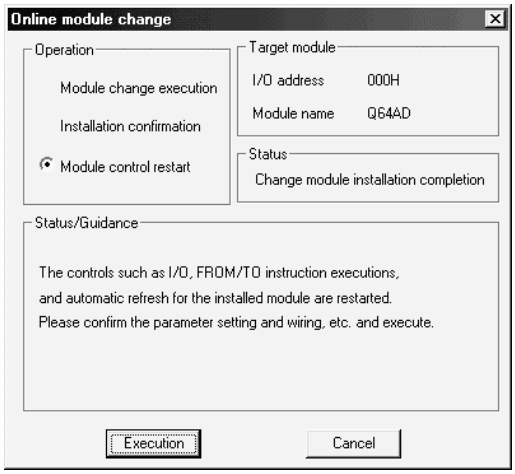
(e) Turn the user range write request (YA) from OFF to ON to restore the user set values to the module.

(f) Referring to (1), enable the conversion of the channel to be used, and monitor the digital output values (buffer memory addresses 11 to 18: Un\G11 to 18) to check that proper conversion has been made.

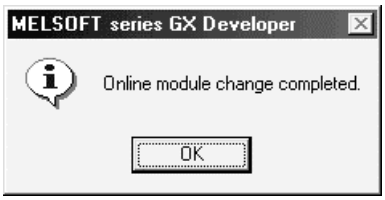
(g) Executing module control resumption resumes control according to the contents of the initial setting program. Make sure that the contents of the initial setting program are correct.

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" screen, click the [Execution] button to resume control. The FROM/TO instruction for the module resumes.



(b) The "Online module change completed" screen appears.



7.4 Range Reference Table

The range reference tables are given below.

(1) Reference table for offset/gain values of industrial shipment settings (buffer memory addresses 202 to 233: Un\G202 to 233)

(a) For Q64AD

The reference values change depending on the setting of the pass data classification setting (buffer memory address 200: Un\G200).

Address (Decimal)				Description	Pass data classification setting	Reference value (Hexadecimal)
CH1	CH2	CH3	CH4			
202	204	206	208	Industrial shipment settings offset value	Voltage specified	Approx. 800C$_H$
					Current specified	Approx. 800C$_H$
203	205	207	209	Industrial shipment settings gain value	Voltage specified	Approx. FA64$_H$
					Current specified	Approx. BD38$_H$

(b) For Q68ADV

Address (Decimal)								Description	Reference value (Hexadecimal)
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8		
202	204	206	208	210	212	214	216	Industrial shipment settings offset value	Approx. 800C$_H$
203	205	207	209	211	213	215	217	Industrial shipment settings gain value	Approx. FA64$_H$

(c) For Q68ADI

Address (Decimal)								Description	Reference value (Hexadecimal)
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8		
202	204	206	208	210	212	214	216	Industrial shipment settings offset value	Approx. 800C$_H$
203	205	207	209	211	213	215	217	Industrial shipment settings gain value	Approx. BD38$_H$

(2) Reference table for user range settings offset/gain values (buffer memory addresses 218 to 233: Un\G218 to 233)

Example: When the offset value and gain value of channel 1 are 1V and 5V, respectively, in the Q68ADV, the reference value of the CH1 user range settings offset value (buffer memory address 218: Un\G218) is approx. 8C46H and that of the CH1 user range settings gain value (buffer memory address 220: Un\G220) is approx. BD64H.

Offset/gain value		Reference value (Hexadecimal)
Voltage	0V	Approx. 800CH
	1V	Approx. 8C46H
	5V	Approx. BD38H
	10V	Approx. FA64H
Current	0mA	Approx. 800CH
	4mA	Approx. 8C46H
	20mA	Approx. FA64H

7.5 Precautions for Online Module Change

The following are the precautions for online module change.

(1) Always perform an online module change in the correct procedure. A failure to do so can cause a malfunction or failure.

(2) If an online module change is made with the user range setting, the accuracy after that will fall to about less than three times of the accuracy before that. Re-set the offset/gain values as necessary.

8 TROUBLESHOOTING

The following section explains the types of errors that may occur when the A/D converter module is used, and how to troubleshoot such errors.

8.1 Error Code List

If an error occurs in the A/D converter module while writing to or reading data from the PLC CPU, the applicable error code is written to buffer memory address 19 (Un\G19).

Table 8.1 Error code list

Error code (decimal)	Error description	Processing
10□	The input range is set an illegal value using the intelligent function module switch in GX Developer. □ indicates the incorrectly specified channel number.	Reset to the correct parameter with GX Developer parameter setting. (See Section 4.5.)
111	Module error at startup.	Turn the power OFF and ON again. If the error occurs again, the module may be malfunctioning. Contact the nearest distributor or branch office with the description of the problem.
161 *1	The G.OGSTOR instruction was executed in the offset/gain setting mode.	Do not execute the G.OGSTOR instruction in the offset/gain setting mode.
162	• The G.OGSTOR instruction was executed consecutively. • At the time of offset/gain setting, a set value was written to the E^2PROM 26 or more times.	• Execute the G.OGSTOR instruction only once for one module. • At the time of offset/gain setting, write a set value only once at one time.
163	The G.OGSTOR instruction was executed for the model that differs from the model for which the G.OGLOAD instruction had been executed.	Execute the G.OGLOAD and G.OGSTOR instructions for the same model.
20□	The average time setting value for buffer memory addresses 1 to 8 (Un\G1 to Un\G8) is outside the range of 2 to 5000 ms. □ indicates the incorrectly specified channel number.	Reset the average time setting to a value within the range of 2 to 5000 ms.
30□	The average number of times setting value for buffer memory addresses 1 to 8 (Un\G1 to Un\G8) is outside the range of 4 to 62500 times. □ indicates the incorrectly specified channel number.	Reset the average number of times setting value to within the range of 4 to 62500 times.
40□	The offset value is equal to or greater than the gain value at the time of user range setting or user range restoration. □ indicates the error causing channel number.	Reset so that the offset value becomes smaller than the gain value.
500	The offset/gain channels were set at the same time during offset and gain value settings, or both were set to 0.	Reset the contents of buffer memory addresses 22 and 23 (Un\G22 and Un\G23).

*1: Not written to the buffer memory address 19 (Un\G19). Written to the completion status area (S)+1 of the G.OGSTOR instruction.

POINT

(1) If more than one error occurs, the error code first detected by the A/D converter module is stored. No other error codes will be stored.
(2) The error can be cleared by setting the error clear request (YF) to "ON".
(3) The error is cleared at the time of mode switching.

8.2 Troubleshooting

8.2.1 When the "RUN" LED is flashing or turned off

(1) When flashing

Check item	Corrective action
Is the mode set to the offset/gain setting mode?	Reset switch 4 of the intelligent function module setting for GX Developer to the normal mode (see Section 4.5).

(2) When off

Check item	Corrective action
Is the power being supplied?	Confirm that the supply voltage for the power supply module is within the rated range.
Is the capacity of the power supply module adequate?	Calculate the current consumption of the CPU module, I/O module and intelligent function module mounted on the base unit to see if the power supply capacity is adequate.
Has a watchdog timer error occurred?	Reset the PLC CPU and verify that it is lit. If the RUN LED does not light even after doing this, the module may be malfunctioning. Contact the nearest distributor or branch office with a description of the problem.
Is the module correctly mounted on the base unit?	Check the mounting condition of the module.
Is a module change enabled during an online module change?	Refer to Chapter 7 and take corrective action.

8.2.2 When the "ERROR" LED is on or flashing

(1) When on

Check item	Corrective action
Is an error being generated?	Confirm the error code and take corrective action described in Section 8.1.

(2) When flashing

Check item	Corrective action
Is intelligent function module setting switch 5 set to "other than 0"?	Using GX Developer parameter setting, set intelligent function module setting switch 5 to "0" (see Section 4.5).

8.2.3 When the digital output values cannot be read

Check item	Corrective action
Is there any fault with the analog signal lines such as disconnection?	Check for faulty condition of the lines visually and perform a continuity check of the signal lines.
Is the CPU module in the STOP status?	Set the CPU module to the RUN status.
Are the offset/gain settings correct?	Verify that the offset/gain settings are correct (see Sections 4.6, 5.6.2 and 5.6.3). If the user range is being used, switch to a different default input range and check if A/D conversion is correctly performed. If it is correctly performed, redo the offset/gain settings.
Is the input range setting correct?	Check buffer memory addresses 20 and 21 (Un\G20 and Un\G21) in GX Developer system monitor. If the input range setting is incorrect, redo the GX Developer intelligent function module switch setting (see Section 4.5).
Is the resolution mode setting correct?	Check the ON/OFF status of the high resolution mode status flag (X8) in GX Developer system monitor. If the resolution mode setting is incorrect, redo the GX Developer intelligent function module switch setting. (See Section 4.5.)
Is the A/D conversion enable/disable setting for the channel that was input set to A/D conversion disabled?	Check the ON/OFF status with buffer memory 0 (Un\G0) in GX Developer system monitor and review the initial setting of the sequence program or utility package (see Section 3.4).
Has the operating condition setting request (Y9) been executed?	From GX Developer, set the operating condition setting request (Y9) from ON to OFF, and check that the digital output values are stored in buffer memory addresses 11 to 18 (Un\G11 to Un\G18). If so, review the initial setting of the Sequence program or utility package (see Section 3.3).

POINT

The module may be faulty if the digital output values cannot be read after proper corrective actions have been taken according to the above check items. Consult the nearest representative or branch.

8.2.4 Checking the A/D converter module status using GX Developer system monitor

When the A/D converter module detail information is selected in GX Developer system monitor, error code, LED ON status and status of the intelligent function module switch setting can be checked.

(1) Operating GX Developer

[Diagnostics] → [System monitor] → "Select A/D converter module" → Module's Detailed Information

(2) Module Detail Information

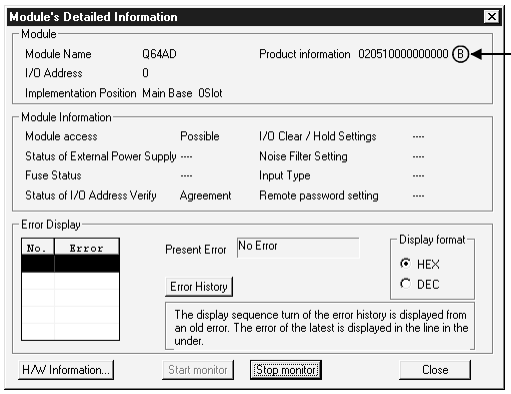
(a) Checking the function version

The function version of the A/D converter module is displayed in the product information field.

(b) Checking the error code

The error code stored in buffer memory address 19 (Un\G19) of the A/D converter module is displayed in the Present Error field.

(When the Error History button is pressed, the contents displayed in the Present Error field are displayed in the No. 1 field.)



Function version

(3) H/W information

(a) H/W LED information

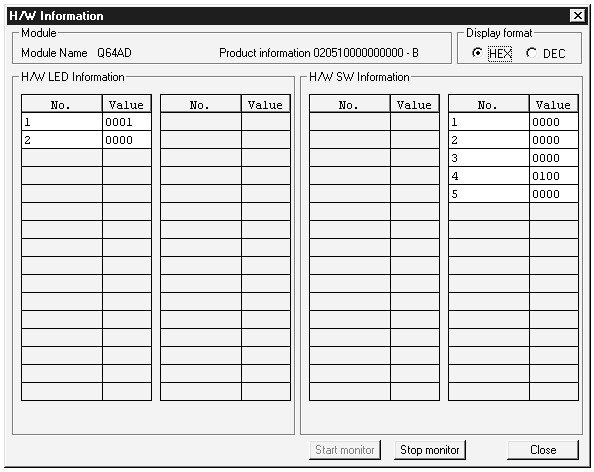
The LED ON status is displayed.

No.	LED name	Status
1	RUN LED	0000_H : Indicates that LED is unlit.
2	ERROR LED	0001_H : Indicates that LED is lit

(b) H/W SW information

The status of the intelligent function module switch setting is displayed.

No.	Switch setting for intelligent function module
1	Switch 1
2	Switch 2
3	Switch 3
4	Switch 4
5	Switch 5



APPENDIX

Appendix 1 Function Upgrade for the A/D Converter Module

The A/D converter modules of function versions B and C have more functions than the conventional model (function version A).
This section describes a comparison of functions of the A/D converter module based on the function additions, combinations with GX Configurator-AD software version and precautions when replacing the module.

Appendix 1.1 A comparison of functions of the A/D converter module

The following table indicates the functions supported by the corresponding function versions.

Function		Function version A	Function version B	Function version C
A/D conversion enable/disable setting		○	○	○
A/D conversion method		—	—	—
	Sampling processing	○	○	○
	Averaging processing	○	○	○
Maximum and minimum values hold function		○	○	○
Temperature drift compensation function		○	○	○
Multiple PLC system compatiblity		×	○	○
Resolution mode		—	—	—
	Normal resolution mode	○	○	○
	High resolution mode	×	○	○
High resolution mode status flag (X8)		×	○	○
Maximum value/minimum value reset completed flag (XD)		×	○	○
Online module change		×	×	○
Switching between normal mode and offset/gain setting mode		—	—	—
	Dedicated instruction (G.OFFGAN)	×	×	○
	Buffer memory (mode switching setting) and Operation Condition Setting Request (Y9)	×	×	○
	GX Configurator-AD	×	×	○
	Intelligent function module switch setting	○	○	○

○ : Compatible × : Not compatible

App.

App. - 1

Appendix 1.2 Combinations of A/D converter module functions and GX Configurator-AD software versions

The following table indicates the A/D converter module functions and corresponding GX Configurator-AD software versions.

Function	Software version			
	SW0D5C-QADU-E 00A	SW0D5C-QADU-E 10B	GX Configurator-AD Version 1.10L to 1.15R	GX Configurator-AD Version 1.16S or later
Normal resolution mode	○	○	○	○
High resolution mode ＊1	×	×	○	○
High resolution mode status flag (X8) ＊1 ＊2	×	×	○	○
Maximum value/minimum value reset completed flag (XD) ＊1 ＊2	×	×	○	○
Multiple PLC system compatibility ＊1	×	×	○	○
Normal mode - offset/gain setting mode switching ＊3	×	×	×	○

○ : Compatible × : Not compatible

＊1 Functions added by function version B.
＊2 When the A/D converter module is function version A and the GX Configurator-AD software version is SW0D5C-QDAU-E 20C or later or GX Configurator-AD Version 1.10L or later, OFF is always displayed.
＊3 Functions added by function version C.

Appendix 1.3 Precautions for replacing the module of function version A with the one of function version B or later

(1) Incorporation into an existing system

You can use the wiring designed for function version A as-is to mount the A/D converter module of function version B or later.

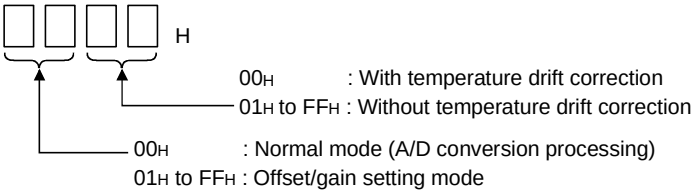
(2) Program utilization

You can use the program created for function version A as-is with the A/D converter module of function version B or later.

(3) Switch setting for intelligent function module

The setting of the offset/gain setting mode differs between function versions A and B or later.
Perform the offset/gain settings after checking the RUN LED flashes in offset/gain setting mode. If the RUN LED does not flash, check to see if the switch 4 setting is correct.
(Refer to Section 4.5 for the intelligent function module switch setting of function version B or later.)

<Contents of switch 4 setting for function version A>



App.

Appendix 2 Dedicated Instruction List

The following table lists the dedicated instructions that can be used with the A/D converter modules.

Instruction	Description	Reference section
G.OFFGAN	Switches to the offset/gain setting mode. Switches to the normal mode.	Appendix 2.1
G.OGLOAD	Reads the offset/gain values of the user range setting to the CPU.	Appendix 2.2
G.OGSTOR	Restores the offset/gain values of the user range setting stored in the CPU to the A/D converter module.	Appendix 2.3

POINT

When the module is mounted to a MELSECNET/H remote station, the dedicated instructions cannot be used.

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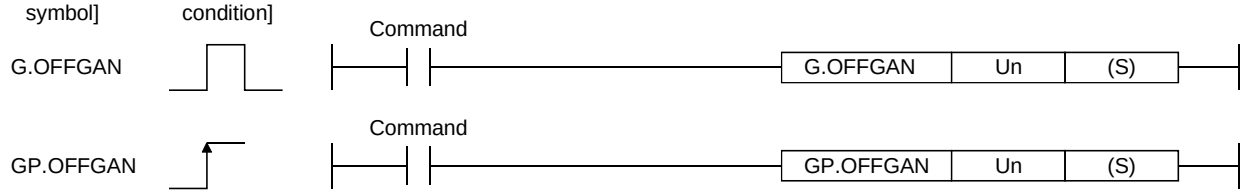
Appendix 2.1 OFFGAN

Switches the mode of the A/D converter module. (Normal mode to offset/gain setting mode, offset/gain setting mode to normal mode)

Set data	Usable devices									
	Internal device (System, user)		File register	MELSECNET/H Direct J□\□		Special function module U□\G□	Index register Z□	Constant		Other
	Bit	Word		Bit	Word			K, H	S	
(S)	—	○		—				—	—	—

[Instruction symbol] [Execution condition]



Set data

Device	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FEH	Binary 16 bits
(S)	Mode switching 0: Switching to normal mode 1: Switching to offset/gain setting mode The setting of any other value results in "switching to offset/gain setting mode".	0 ,1	Binary 16 bits

(1) Function

Switches the mode of the A/D converter module.

- Normal mode to offset/gain setting mode (the offset/gain setting mode status flag (XA) turns ON)
- Offset/gain setting mode to normal mode (the offset/gain setting mode status flag (XA) turns OFF)

POINT

(1) When the offset/gain setting mode is switched to the normal mode, Module Ready (X0) turns from OFF to ON.
Note that initial setting processing will be executed if there is a sequence program that makes initial setting when Module Ready (X0) turns ON.

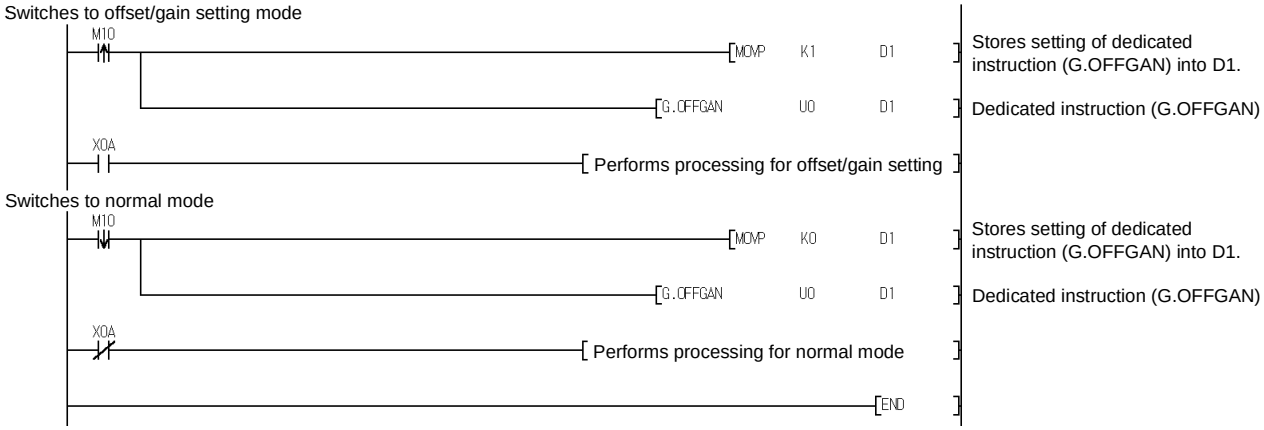
(2) When the offset/gain setting mode is switched to the normal mode, the A/D converter module holds the previous operation condition and resumes operation automatically under the previous operation condition.

(2) Operation error

No errors.

(3) Program example

The following program is designed to switch the A/D converter module mounted in the position of I/O number X/Y0 to X/YF to the offset/gain setting mode when M10 is turned ON, and to return it to the normal mode when M10 is turned OFF.



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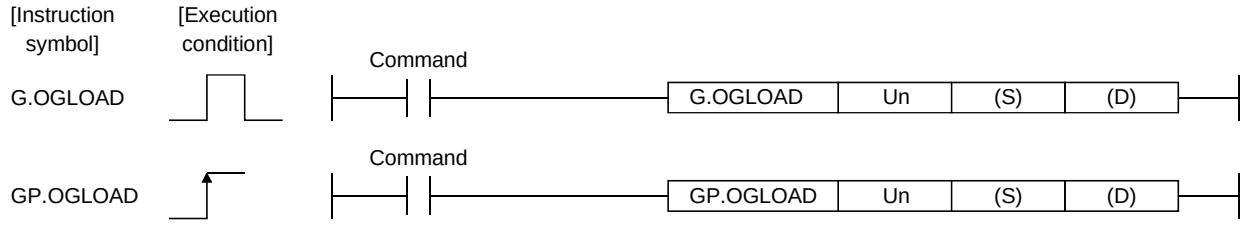
Appendix 2.2 OGLOAD

Reads the offset/gain values of the user range setting of the A/D converter module to the CPU.

Set data	Usable devices									
	Internal device (System, user)		File register	MELSECNET/H Direct J□\□		Special function module U□\G□	Index register Z□	Constant		Other
	Bit	Word		Bit	Word			K, H	S	
(S)	—	○		—				—	—	—
(D)	○			—				—	—	—



Set data

Device	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FEH	Binary 16 bits
(S)	Start number of the device in which control data is stored.	Within the range of the specified device	Device name
(D)	Device that is turned ON 1 scan on completion of dedicated instruction processing. (D) + 1 also turns ON at an abnormal completion.	Within the range of the specified device	Bit

Control data *1 of Q64AD (1/2)

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2	Pass data classification setting	Specify the voltage/current of the offset/gain values to be read. 0: Voltage specified 1: Current specified b15 ~ b4 b3 b2 b1 b0 0 ~ 0 CH.4 CH.3 CH.2 CH.1	0000H to 000FH	User
(S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System

*1 Set only the pass data classification setting (S)+2. If data is written to the area set by the system, the offset/gain values will not be read properly.

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Control data *1 of Q64AD (2/2)

Device	Item	Set data	Setting range	Set by
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH1 User range settings offset value	—	—	System
(S) + 13	CH1 User range settings gain value	—	—	System
(S) + 14	CH2 User range settings offset value	—	—	System
(S) + 15	CH2 User range settings gain value	—	—	System
(S) + 16	CH3 User range settings offset value	—	—	System
(S) + 17	CH3 User range settings gain value	—	—	System
(S) + 18	CH4 User range settings offset value	—	—	System
(S) + 19	CH4 User range settings gain value	—	—	System

*1 Set only the pass data classification setting (S)+2. If data is written to the area set by the system, the offset/gain values will not be read properly.

Control data *2 of Q68ADV (1/2)

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2 (S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16	CH7 Industrial shipment settings offset value	—	—	System
(S) + 17	CH7 Industrial shipment settings gain value	—	—	System
(S) + 18	CH8 Industrial shipment settings offset value	—	—	System
(S) + 19	CH8 Industrial shipment settings gain value	—	—	System
(S) + 20	CH1 User range settings offset value	—	—	System
(S) + 21	CH1 User range settings gain value	—	—	System
(S) + 22	CH2 User range settings offset value	—	—	System
(S) + 23	CH2 User range settings gain value	—	—	System
(S) + 24	CH3 User range settings offset value	—	—	System
(S) + 25	CH3 User range settings gain value	—	—	System
(S) + 26	CH4 User range settings offset value	—	—	System
(S) + 27	CH4 User range settings gain value	—	—	System
(S) + 28	CH5 User range settings offset value	—	—	System
(S) + 29	CH5 User range settings gain value	—	—	System

*2 Setting is not necessary. If setting is made, the offset/gain values will not be read properly.

Control data *2 of Q68ADV (2/2)

Device	Item	Set data	Setting range	Set by
(S) + 30	CH6 User range settings offset value	—	—	System
(S) + 31	CH6 User range settings gain value	—	—	System
(S) + 32	CH7 User range settings offset value	—	—	System
(S) + 33	CH7 User range settings gain value	—	—	System
(S) + 34	CH8 User range settings offset value	—	—	System
(S) + 35	CH8 User range settings gain value	—	—	System

*2 Setting is not necessary. If setting is made, the offset/gain values will not be read properly.

Control data *3 of Q68ADI

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2	System area	—	—	—
(S) + 3				
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16	CH7 Industrial shipment settings offset value	—	—	System
(S) + 17	CH7 Industrial shipment settings gain value	—	—	System
(S) + 18	CH8 Industrial shipment settings offset value	—	—	System
(S) + 19	CH8 Industrial shipment settings gain value	—	—	System
(S) + 20	CH1 User range settings offset value	—	—	System
(S) + 21	CH1 User range settings gain value	—	—	System
(S) + 22	CH2 User range settings offset value	—	—	System
(S) + 23	CH2 User range settings gain value	—	—	System
(S) + 24	CH3 User range settings offset value	—	—	System
(S) + 25	CH3 User range settings gain value	—	—	System
(S) + 26	CH4 User range settings offset value	—	—	System
(S) + 27	CH4 User range settings gain value	—	—	System
(S) + 28	CH5 User range settings offset value	—	—	System
(S) + 29	CH5 User range settings gain value	—	—	System
(S) + 30	CH6 User range settings offset value	—	—	System
(S) + 31	CH6 User range settings gain value	—	—	System
(S) + 32	CH7 User range settings offset value	—	—	System
(S) + 33	CH7 User range settings gain value	—	—	System
(S) + 34	CH8 User range settings offset value	—	—	System
(S) + 35	CH8 User range settings gain value	—	—	System

*3 Setting is not necessary. If setting is made, the offset/gain values will not be read properly.

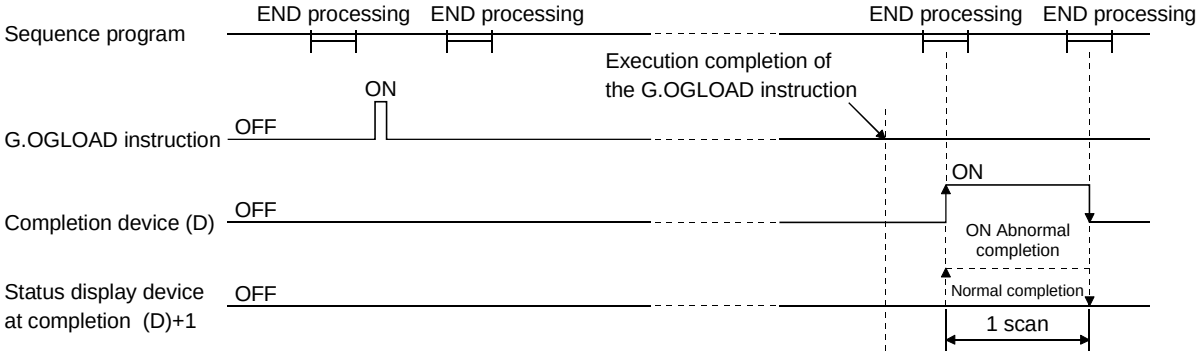
(1) Functions

(a) Reads the offset/gain values of the user range setting of the A/D converter module to the CPU.

(b) There are two types of interlock signals for the G.OGLOAD instruction: the completion device (D) and the status display device at completion (D) + 1.

1) Completion device
Turns ON in the END processing of the scan where the G.OGLOAD instruction is completed, and turns OFF in the next END processing.

2) Status display device at completion
Turns ON and OFF depending on the completion status of the G.OGLOAD instruction.
Normal completion : Stays OFF and does not change.
Abnormal completion: Turns ON in the END processing of the scan where the G.OGLOAD instruction is completed, and turns OFF in the next END processing.

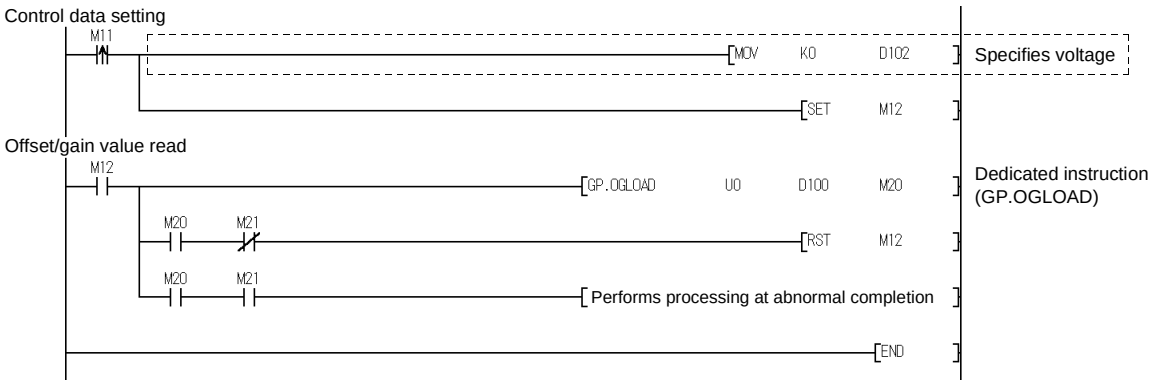


(2) Operation error

No errors.

(3) Program example

The following program is designed to read the offset/gain values of the A/D converter module mounted in the position of I/O number X/Y0 to X/YF when M11 is turned ON.

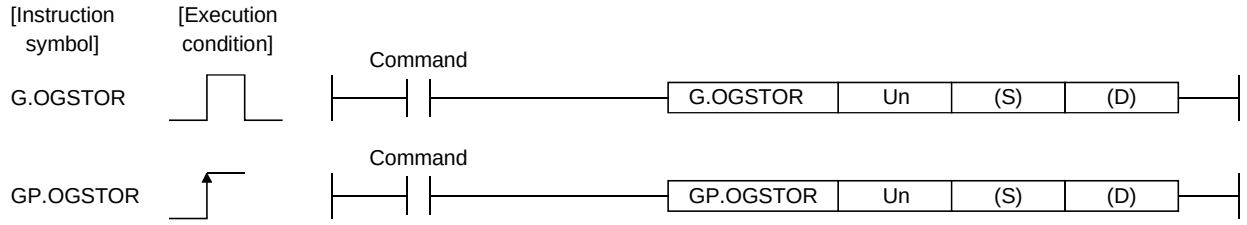


∗ For the Q68ADV/Q68ADI, the program in the dotted area is not necessary.

Appendix 2.3 OGSTOR

Restores the offset/gain values of the user range setting stored in the CPU to the A/D converter module.

Set data	Usable devices									
	Internal device (System, user)		File register	MELSECNET/H Direct J□\□		Special function module U□\G□	Index register Z□	Constant		Other
	Bit	Word		Bit	Word			K, H	S	
(S)	—	○		—				—	—	—
(D)	○			—				—	—	—



Set data

Device	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FE$_H$	Binary 16 bits
(S) ＊1	Start number of the device in which control data is stored.	Within the range of the specified device	Device name
(D)	Device that is turned ON 1 scan on completion of dedicated instruction processing. (D) + 1 also turns ON at an abnormal completion.	Within the range of the specified device	Bit

＊1 When executing the G.OGLOAD instruction, specify the device designated in (S).
Do not change the data read with the G.OGLOAD instruction.
If it is changed, normal operation cannot be guaranteed.

Control data of Q64AD (1/2)

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2	Pass data classification setting	The value set to Pass data classification setting (S)+2 using the G.OGLOAD instruction is stored. 0: Voltage specified 1: Current specified b15 ~ b4 b3 b2 b1 b0 0 ~ 0 CH.4 CH.3 CH.2 CH.1	0000$_H$ to 000F$_H$	User
(S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System

Control data of Q64AD (2/2)

Device	Item	Set data	Setting range	Set by
(S) + 12	CH1 User range settings offset value	—	—	System
(S) + 13	CH1 User range settings gain value	—	—	System
(S) + 14	CH2 User range settings offset value	—	—	System
(S) + 15	CH2 User range settings gain value	—	—	System
(S) + 16	CH3 User range settings offset value	—	—	System
(S) + 17	CH3 User range settings gain value	—	—	System
(S) + 18	CH4 User range settings offset value	—	—	System
(S) + 19	CH4 User range settings gain value	—	—	System

Control data of Q68ADV

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2	System area	—	—	—
(S) + 3				
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16	CH7 Industrial shipment settings offset value	—	—	System
(S) + 17	CH7 Industrial shipment settings gain value	—	—	System
(S) + 18	CH8 Industrial shipment settings offset value	—	—	System
(S) + 19	CH8 Industrial shipment settings gain value	—	—	System
(S) + 20	CH1 User range settings offset value	—	—	System
(S) + 21	CH1 User range settings gain value	—	—	System
(S) + 22	CH2 User range settings offset value	—	—	System
(S) + 23	CH2 User range settings gain value	—	—	System
(S) + 24	CH3 User range settings offset value	—	—	System
(S) + 25	CH3 User range settings gain value	—	—	System
(S) + 26	CH4 User range settings offset value	—	—	System
(S) + 27	CH4 User range settings gain value	—	—	System
(S) + 28	CH5 User range settings offset value	—	—	System
(S) + 29	CH5 User range settings gain value	—	—	System
(S) + 30	CH6 User range settings offset value	—	—	System
(S) + 31	CH6 User range settings gain value	—	—	System
(S) + 32	CH7 User range settings offset value	—	—	System
(S) + 33	CH7 User range settings gain value	—	—	System
(S) + 34	CH8 User range settings offset value	—	—	System
(S) + 35	CH8 User range settings gain value	—	—	System

Control data of Q68ADI

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2 (S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16	CH7 Industrial shipment settings offset value	—	—	System
(S) + 17	CH7 Industrial shipment settings gain value	—	—	System
(S) + 18	CH8 Industrial shipment settings offset value	—	—	System
(S) + 19	CH8 Industrial shipment settings gain value	—	—	System
(S) + 20	CH1 User range settings offset value	—	—	System
(S) + 21	CH1 User range settings gain value	—	—	System
(S) + 22	CH2 User range settings offset value	—	—	System
(S) + 23	CH2 User range settings gain value	—	—	System
(S) + 24	CH3 User range settings offset value	—	—	System
(S) + 25	CH3 User range settings gain value	—	—	System
(S) + 26	CH4 User range settings offset value	—	—	System
(S) + 27	CH4 User range settings gain value	—	—	System
(S) + 28	CH5 User range settings offset value	—	—	System
(S) + 29	CH5 User range settings gain value	—	—	System
(S) + 30	CH6 User range settings offset value	—	—	System
(S) + 31	CH6 User range settings gain value	—	—	System
(S) + 32	CH7 User range settings offset value	—	—	System
(S) + 33	CH7 User range settings gain value	—	—	System
(S) + 34	CH8 User range settings offset value	—	—	System
(S) + 35	CH8 User range settings gain value	—	—	System

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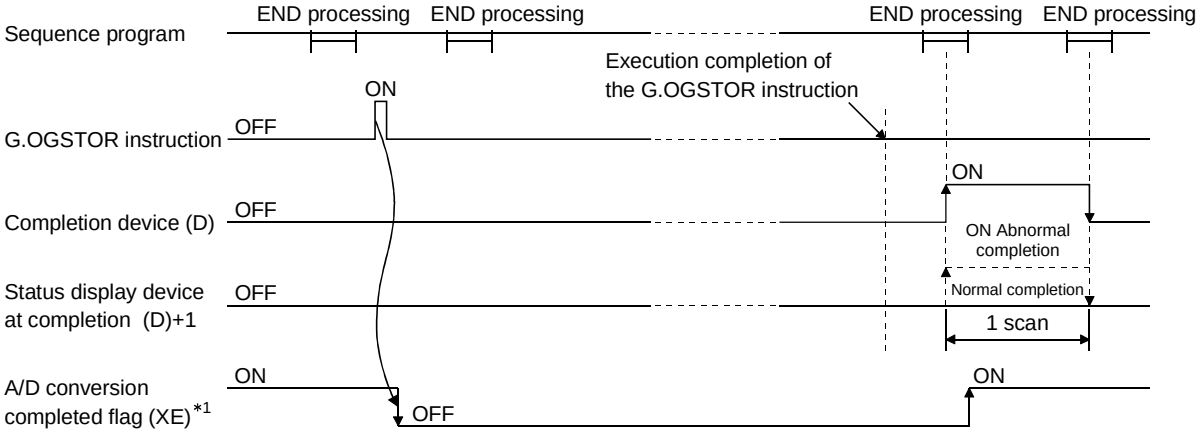
(1) Functions

(a) Restores the offset/gain values of the user range setting stored in the CPU to the A/D converter module.

(b) There are two types of interlock signals for the G.OGSTOR instruction: the completion device (D) and the status display device at completion (D) + 1.

1) Completion device
Turns ON in the END processing of the scan where the G.OGSTOR instruction is completed, and turns OFF in the next END processing.

2) Status display device at completion
Turns ON and OFF depending on the completion status of the G.OGSTOR instruction.
Normal completion : Stays OFF and does not change.
Abnormal completion: Turns ON in the END processing of the scan where the G.OGSTOR instruction is completed, and turns OFF in the next END processing.



*1 When the G.OGSTOR instruction is executed, A/D conversion is not performed. After the completion device (D) turns ON, A/D conversion starts, the A/D conversion value is stored into the buffer memory, and the A/D conversion completed flag (XE) then turns ON.

(c) When the offset/gain values are restored, the reference accuracy falls to less than ±0.15%.

(2) Operation error

In any of the following cases, an error occurs and the corresponding error code is stored into the completion status area (S)+1.

Error code	Case resulting in operation error
161	The G.OGSTOR instruction was executed in the offset/gain setting mode.
162	The G.OGSTOR instruction was executed consecutively.
163	The G.OGSTOR instruction was executed for the model that differs from the model for which the G.OGLOAD instruction had been executed.

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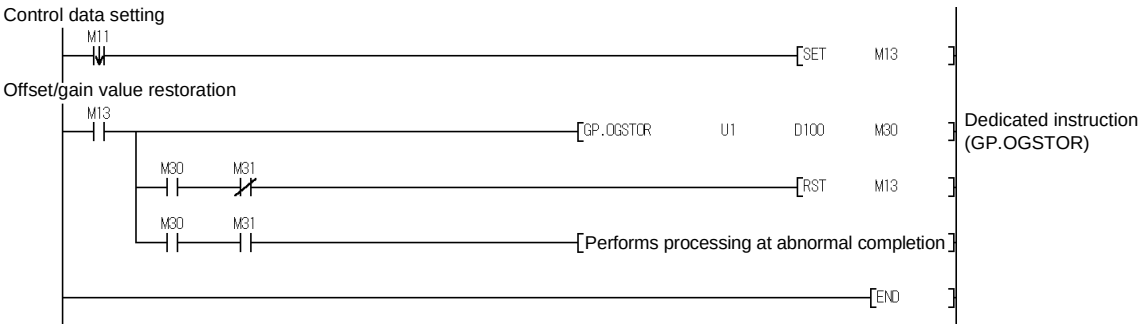
(3) Program example

The following program is designed to read the offset/gain values of the A/D converter module mounted in the position of I/O number X/Y0 to X/YF when M11 is turned ON.



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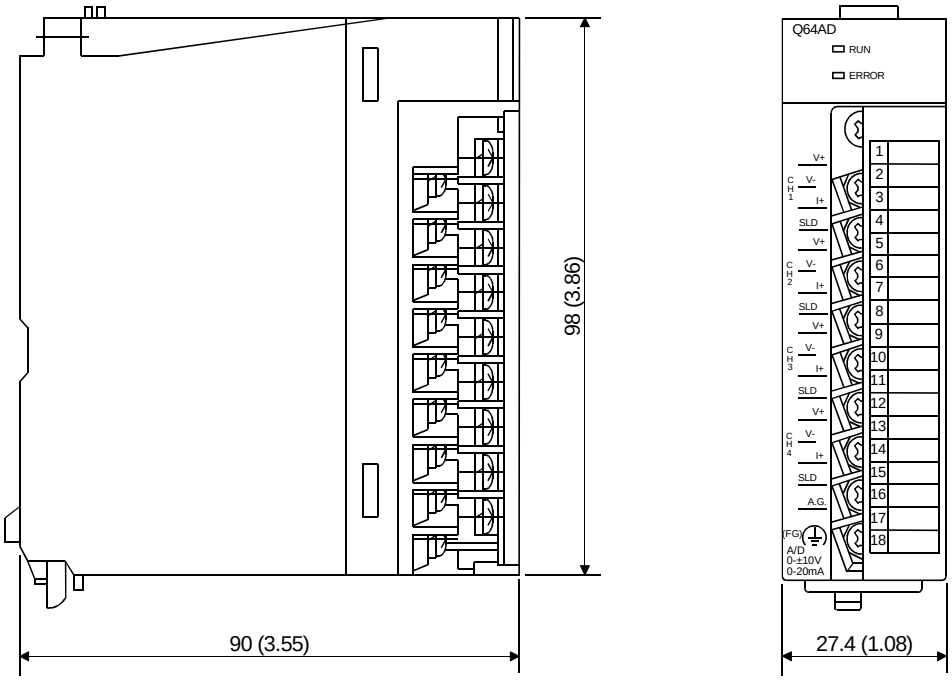
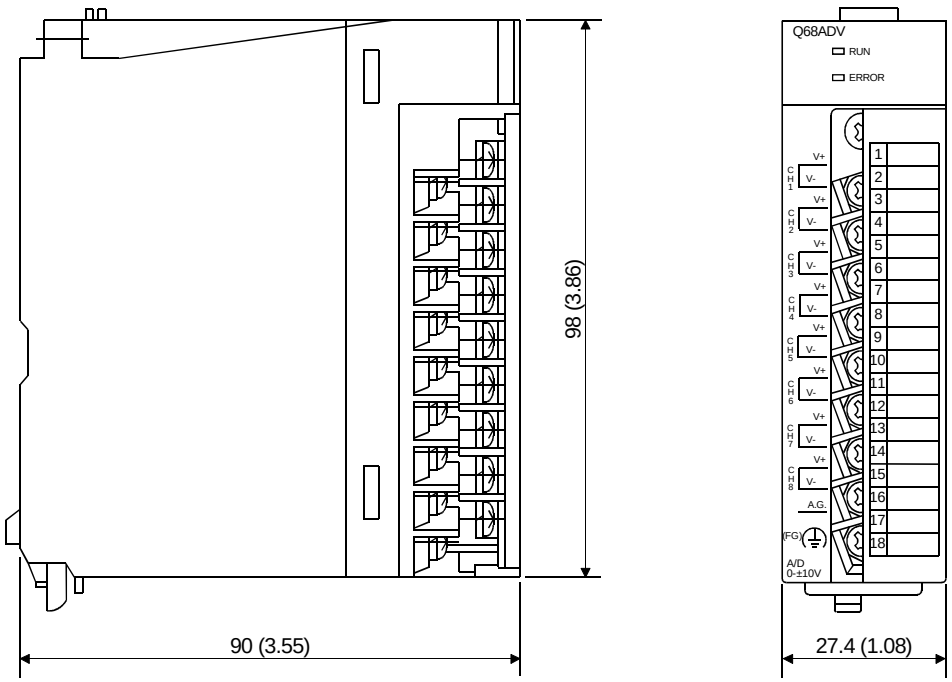
Appendix 3 External Dimension Diagram

(1) Q64AD



(2) Q68ADV



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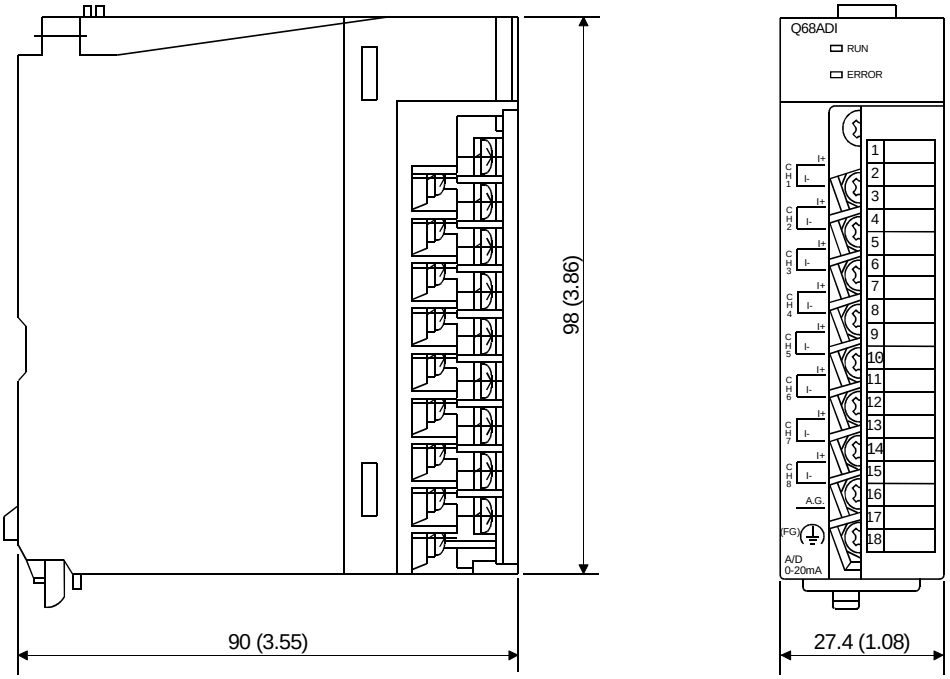
(3) Q68ADI



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WARRANTY

Please confirm the following product warranty details before starting use.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the dealer or Mitsubishi Service Company. Note that if repairs are required at a site overseas, on a detached island or remote place, expenses to dispatch an engineer shall be charged for.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.

Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not possible after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of chance loss and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to damages caused by any cause found not to be the responsibility of Mitsubishi, chance losses, lost profits incurred to the user by Failures of Mitsubishi products, damages and secondary damages caused from special reasons regardless of Mitsubishi's expectations, compensation for accidents, and compensation for damages to products other than Mitsubishi products and other duties.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or National Defense purposes shall be excluded from the programmable logic controller applications.

Note that even with these applications, if the user approves that the application is to be limited and a special quality is not required, application shall be possible.

When considering use in aircraft, medical applications, railways, incineration and fuel devices, manned transport devices, equipment for recreation and amusement, and safety devices, in which human life or assets could be greatly affected and for which a particularly high reliability is required in terms of safety and control system, please consult with Mitsubishi and discuss the required specifications.

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Analog-Digital Converter Module

User's Manual

MODEL	Q-A/D-U-S-E
MODEL CODE	13JR03
SH(NA)-080055-G(0305)MEE	

MITSUBISHI ELECTRIC CORPORATION

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NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN

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Specifications subject to change without notice.